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ECONOMIC ANALYSIS OF EFFLUENT GUIDELINES.
THE ELECTROPLATING INDUSTRY
COPPER, NICKEL, CHROMIUM AND ZINC

A. T. KEARNEY, INCORPORATED

PREPARED FOR
ENVIRONMENTAL PROTECTION AGENCY

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The report summarizes the economic impact of water pollution abatement on the Electroplating Industry (Copper, Nickel, Chromium and Zinc). Discussed are the industry structure, financial profile, sources of water pollution, projected costs and price increases, and the effects on production, plant closings, and local communities.

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ECONOMIC ANALYSIS
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SEPTEMBER, 1974

OFFICE OF PLANNING AND EVALUATION
U.S. ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D. C. 20460

CONTRACT NO. 68-01-1545

PREFACE

The attached document is a contractor's study prepared for the Office of Planning and Evaluation of the Environmental Protection Agency ("EPA"). The purpose of the study is to analyze the economic impact which could result from the application of alternative effluent limitation guidelines and standards of performance to be established under Sections 304(b) and 306 of the Federal Water Pollution Control Act, as amended.

The study supplements the technical study ("EPA Development Document") supporting the issuance of proposed regulations under Sections 304(b) and 306. The Development Document surveys existing and potential waste treatment control methods and technology within particular industrial source categories and supports proposal of certain effluent limitation guidelines and standards of performance based upon an analysis of the feasibility of these guidelines and standards in accordance with the requirements of Sections 304(b) and 306 of the Act. Presented in the Development Document are the investment and operating costs associated with various alternative control and treatment technologies. The attached document supplements this analysis by estimating the broader economic effects which might result from the required application of various control methods and technologies. This study investigates the effect of alternative approaches in terms of product price increases, effects upon employment and the continued viability of affected plants, effects upon foreign trade and other competitive effects.

The study has been prepared with the supervision and review of the Office of Planning and Evaluation of EPA. This report was submitted in fulfillment of Contract No. 68-01-1545, Task Orders No. 1, 4 & 6 by A. T. Kearney, Inc. Work was completed as of September, 1974.

This report is being released and circulated at approximately the same time as publication in the Federal Register of a notice of proposed rule making under Sections 304(b) and 306 of the Act for the subject point source category. The study is not an official EPA publication. It will be considered along with the information by EPA on either document before or during proposed rule making proceedings necessary to establish final regulations. Prior to final promulgation of regulations, the accompanying study shall have standing in any EPA proceeding or court proceeding only to the extent that it represents the views of the contractor who studied the subject industry. It cannot be cited, referenced, or represented in any respect in any such proceeding as a statement of EPA's views regarding the subject industry.

EPA REVIEW NOTICE

This report has been reviewed by the Office of Planning and Evaluation of EPA and approved for publication. Approval does not signify that the contents necessarily reflect the views and policies of the Environmental Protection Agency, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

ENVIRONMENTAL PROTECTION AGENCY

ECONOMIC ANALYSIS OF EFFLUENT GUIDELINES ELECTROPLATING INDUSTRY

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ENVIRONMENTAL PROTECTION AGENCY

ECONOMIC ANALYSIS OF THE PROPOSED EFFLUENT GUIDELINES FOR THE ELECTROPLATING INDUSTRY

EXECUTIVE SUMMARY

INTRODUCTION

It was the objective of this study to determine the impact of the costs of water pollution abatement on the Electroplating Industry. The study was restricted in scope to an analysis of four metals: Copper, Nickel, Chromium and Zinc, used in electroplating and the effluents resulting from the use of these metals. This study covered those plants included in the four digit SIC Code 3471.

We would like to acknowledge the participation of Fred Gurnham Associates and Mr. Scott Modjeska in the technical aspects of this study, as well as the cooperation of the National Association of Metal Finishers in the supply of data and information relevant to the study.

THE INDUSTRY

(a) Number of Industry Establishments

The number of electroplating, anodizing, polishing and coating establishments in SIC 3471 is as shown in the table on the following page based on information from the Bureau of Census.

Table 1

Number of Establishments in SIC 3471

Year	Establishments
1967	3,241
1972	3,220

Source: Census of Manufactures, U.S. Dept. of Commerce

The establishments in the table reflect the number of separately operated plating and polishing shops. These are classified in SIC Code 3471. Some of those shops are owned and operated by other companies for their own use even though they operate separately from the parent company. The great majority, however, are independently owned and operated businesses.

(b) Employment Size

The following table shows reported employment of plating and polishing installations:

Table 2

Industry Employment - SIC 3471

Year	Establishments
1967	55,100
1972	53,300

Source: Census of Manufactures, U.S. Dept. of Commerce

(c) Types of Firms

The industry consists of firms which perform various types of electroplating; e.g., specialists in copper-nickel-chrome, hard chrome, zinc, precious metals, cadmium, anodizers and others. A large number of firms are also diversified and perform a broad range of electroplating services.

The scope of this study included only firms which performed copper, nickel, chromium and zinc electroplating. Other types of plating and anodizing are to be covered in a separate study of the Metal Finishing Industry.

Based on principal plating processes performed, the sub-segments of the industry covered by this study have been estimated to be as follows:

Table 3

Number of Copper, Nickel, Chromium, and Zinc Electroplating Establishments

Principal Types of Plating	Number of Establishments	Employment
Copper	318	5,693
Nickel	231	4,262
Chromium	796	14,825
Zinc	1,078	17,551
Total Cu, N, Cr, Zn Plants	2,423	42,331
Total Other Plating and Coating Plants	818	12,769
Total All Plants in SIC 3471	3,241	555,100

Source: 1967 Census of Manufactures

Segmentation of the industry has also been made based on size of establishments as determined by number of employees. 1967 Census of Manufactures data was used since this was the last year for which size data was published. This segmentation by size is given in Table 4.

Table 4

Sizes of Establishments - Cu, N, Cr, Zn Platers

Employees Per Plant	Number of Establishments	Number of Employees
1 - 4	924	1,871
5 - 9	426	3,017
10 - 19	433	6,130
20 - 49	463	14,065
50 - 99	128	8,666
Over 100	49	8,582
Total	2,423	42,331

Source: 1967 Census of Manufactures

It was determined that segmentation of the industry based upon level of integration, number of plants, number of products and level of diversification, is not appropriate for this study, since such factors do not significantly affect the ability of a company to bear the cost of investment for pollution control equipment. Segmentation was based on sizes of establishment, since this was determined to be the principal factor affecting the ability of a company to bear the investment costs for pollution control.

(d) Expected Impact by Industry Segments

It is expected that large shops will be impacted but not as severely as the small shops. Information collected during the study indicated the following:

1. Low sales volumes for small shops, thus indicating insufficient cash flow for purchasing expensive control equipment.
2. Inability of small shops to obtain debt financing.
3. Constraints on physical plant space thus adding to the capital requirements, particularly if additional land is required to maintain the same volume.

(e) Scope of the Study

The study was limited to establishments in SIC Group 3471 whose primary service is plating copper, nickel, chromium and zinc. SIC 3471 includes additional establishments specializing in plating other substances which are covered in the Metal Finishing Industry study.

SEGMENTATION

Segments of the industry are analyzed in considerable detail in Sections III and IV of the report. The study was further limited to independent shops of less than 100 employees because it was believed that the large firms, with over 100 employees, would not be severely impacted by the guidelines. The shops with under 100 employees account for the majority of the industry work force.

Plant groups were established based on employment size. The parameters of these groups are shown in Table 5.

Table 5

Industry Segment Parameters
(For Plants Under 100 Employees)

Plant*** Size Codes	Number of Plants: Municipal* Dischargers	Direct** Dischargers	Total	Average Number of Employees Per Plant	Average Number Sales Per Plant ($.000)
A	711	213	924	2	$ 40.3
B	328	98	426	7	135.0
C	333	100	433	14	262.9
D	357	106	463	30	594.3
E	99	29	128	67	1,345.5
Total	1,828	546	2,374		

* Plants discharging effluents to minicipal sewer systems.

** Plants discharging effluents to navigable waters.

*** For Plant Code see EXHIBIT V-6.

Source: EPA Report 12210 E/E 03/71

The impact due to water pollution abatement costs on the plants shown on the preceding page are discussed in the paragraph, Impact Analysis.

EFFLUENT LIMITATIONS USED FOR THIS STUDY

In order to evaluate the economic impact of pollution abatement requirements on the Electroplating Industry, it was necessary to establish effluent limitations based on plant size groups. In conjunction with the Environmental Protection Agency, two alternatives were established for levels of treatment for direct dischargers and municipal system users, as shown in Table 6 on the following page.

Table 6

Alternate Effluent Limitations

Alternate	1977 Direct Dischargers	1977 Municipal Dischargers	1983 Direct Dischargers
A	BPT (1)	Pretreatment (2)	BAT (3)
B	BPT	BPT (4)	BAT

(1) Best Practicable Technology.
(2) Pretreatment standards for municipal dischargers, requiring lower costs than BPT.
(3) Best Available Technology.
(4) BPT proposed guidelines for municipal dischargers equal to BPT for direct dischargers.

Source: Environmental Protection Agency

Small Plant Exemption

Small direct dischargers have been classified by EPA as plants processing less than 33 square meters per hour, or having installed direct current capacity not exceeding 2,000 amperes. These plants will be required to install technology to meet less stringent BPT standards than the larger plants.

COST OF WATER POLLUTION CONTROL

Cost data were supplied by Battelle Columbus Laboratories. Investment costs are based on the volume of water treated, which depends on the number of square feet per hour plated, per employee. Operating costs were also based upon the square feet plated per hour, per employee, and man-hours worked per employee, per year.

The investment and operating cost data for BPT and BAT for Alternates A and B are summarized in Table 7 and 8 below.

TABLE 7

ALTERNATE A

COST OF POLLUTION ABATEMENT EQUIPMENT FOR ELECTROPLATING INDUSTRY

Model Plant Code	1977 Standards (1)				1983 Standards (2)	
	Municipal Dischargers		Direct Dischargers		Direct Dischargers	
	Investment (3) (.000)	Annual Operating Costs	Investment (.000)	Annual Operating Costs	Investment (.000)	Annual Operating Costs
A	$ 25.0	$ 795	$ 50.0	$ 795	$ 20.0	$ 825
B	29.4	2,780	58.8	5,565	20.0	2,895
C	58.8	5,565	117.6	11,130	73.0	5,790
D	126.0	11,925	252.0	23,850	133.5	12,405
E	281.0	26,630	562.0	53,265	288.8	27,705

(1) Best practicable technology.
(2) Best available technology.
(3) All costs are per average plant.

Source: Battelle Columbus Laboratories
Environmental Protection Agency

TABLE 8

ALTERNATE B

COST OF POLLUTION ABATEMENT EQUIPMENT FOR ELECTROPLATING INDUSTRY

Model Plant Code	1977 Standards (1)				1983 Standards (2)	
	Municipal Dischargers		Direct Dischargers		Direct Dischargers	
	Investment (3) (.000)	Annual Operating Costs	Investment (.000)	Annual Operating Costs	Investment (.000)	Annual Operating Costs
A	$ 25.0	$ 795	$ 25.0	$ 795	$ 20.0	$ 825
B	58.8	5,565	58.8	5,565	20.0	2,895
C	117.6	11,130	117.6	11,130	73.0	5,790
D	252.0	23,850	252.0	23,850	133.5	12,405
E	562.0	53,265	562.0	53,265	288.8	27,705

(1) Best practicable technology.
(2) Best available technology.
(3) All costs are per average plant.

Source: Battelle Columbus Laboratories
Environmental Protection Agency

FINANCIAL PROFILE

(a) Sales and Profits

A limited amount of information has been available within the Electroplating Industry relative to the financial condition of individual firms. This limited published data, industry studies and direct contact with individual firms, were used to develop a financial profile of the industry segments.

Five model plant sizes were established with the financial data as shown in Table 9.

Table 9

Financial Data

Model Plant Code	Employee Range	Average Sales Dollars ($000)	Average Pre-tax Profit on Sales (%)
A	1 - 4	$ 40.3	9.0 %
B	5 - 9	135.0	6.5
C	10 - 19	262.9	4.9
D	20 - 49	594.3	7.2
E	50 - 99	1,345.5	4.2

Average pretax profit for all of the plants was 5.9%.

Source: A. T. Kearney Industry Survey, 1973
Dun & Bradstreet

(b) Value of Assets

The Electroplating Industry is characterized by relatively low capital investment in equipment, land and buildings. Once purchased and installed, the market value of electroplating equipment decreases rapidly. It is estimated that the market value of used equipment is worth about 15% to 20% of the purchase price after two years of operation.

(c) Financing Capital Requirements

The following are the methods employed by the electroplating firms to obtain financing for initial or additional capital requirements.

1. Commercial Banks, in general, are the primary source of financing for firms in the Electroplating Industry. However, small companies experience major difficulty in obtaining financing for both productive and nonproductive assets. Small companies often have to pledge privately held assets, not necessarily business related, of value equal to or greater than the amount of the loan. Since most companies are small, with low capital investment, the asset security is a problem.

The Bank's most important consideration is the ability to service the debt and the personal reputation of the business owners.

2. SBA Loans are typically available and used for some of the small platers. Although this may represent a viable source for small businesses, these loans require a considerable amount of detailed information for qualification and take long amounts of time for issuance.

3. Equity Financing - Most of the companies in the industry are either closely held corporations or partnerships. There are few public corporations. For this reason, the normal method of outside financing is by bank loan. Very little financing is done by issuance of stock.

4. Private Sources - Since many of the companies are owned and operated as a family business, another source of financing is the family itself. The private resources of the family may be drawn upon when necessary if available.

5. Government Assistance - Several people interviewed in the industry survey expressed a desire for some form of government assisted financing of pollution control equipment such as used for financing OSHA and mine safety projects.

6. Industrial Revenue Bonds have been used to finance pollution abatement equipment. The value of bonds issued has increased from $85 million in 1971 to $1 billion in 1973. These bonds generally carry a rate of 6%. Due to the high cost of issuing these bonds, the value issued is generally in excess of one-half million dollars. Presently, only the very largest of the electroplating shops would be able to avail themselves of this type of financing. This type of financing presently will not assist the small shops to finance pollution abatement equipment.

IMPACT ANALYSIS

The impact analysis was based on previously described plant size parameters, costs of pollution abatement equipment, average profits for each segment, availability of capital to finance abatement equipment, and interviews with consultants and industry sources.

(a) 1977 Standards (BPT)

The total investment costs required for the copper, nickel, chromium and zinc shops in the Electroplating Industry (as covered by SIC 3471) to meet the 1977 standards are approximately $242 million for Alternate A and approximately $379 million for Alternate B. The annual operating cost increase is expected to amount to $85 million for Alternate A and $135 million for Alternate B. The following are the projected price increases for each of the plant groups necessary to pay for additional costs of pollution abatement. The average price increase will be 8.3 percent for municipal dischargers and 15.5 percent for direct dischargers according to Alternate A. The price increase associated with Alternate B is 15.5 percent for both municipal and direct dischargers.

Table 10

Projected Price Increases

Plant Code	Alternate A Percent Increase		Alternate B Percent Increase
	Municipal Dischargers	Direct Dis-Chargers	Municipal and Direct Dischargers
A	18.3%	18.3%	18.3%
B	7.7	15.4	15.4
C	8.0	16.0	16.0
D	7.6	15.2	15.2
E	7.5	15.0	15.0
Weighted Average	8.3	15.5	15.5

Source: Exhibit VI-6

(b) 1983 Standards (BAT)

The industry is projected to require an additional investment of $43 million in order to meet proposed 1983 standards. The additional annual operating costs of operation are estimated to be $15 million.

It is believed that these costs will, in the majority of cases, be passed on in the form of price increases. If this happens, an average additional price increase of 8.4 percent will be incurred for those plants in the direct discharge segment. No additional increase will occur for plants discharging to municipal systems.

(c) Plant Closings

Based on the data analyzed and interviews with the Electroplating Industry and bank representatives, it is believed that the proposed water pollution control standards will result in potential plant closures for Alternates A and B as shown in the following tables.

Table 11

Potential Plant Closures - Alternate A

Number of Plants

Type of Plant	1977 (BPT) Number	1977 (BPT) Percent	1983 (BAT) Number	1983 (BAT) Percent	Total Number	Total Percent
Municipal Dischargers	242	13.2%	-	- %	242	13.2%
Direct Dischargers	92	16.8	24	5.3	116	21.2
Total	334	14.1%	24	5.3%	358	15.1%

Source: Exhibits VII-4, VII-6, VII-7

Table 12

Potential Plant Closures - Alternate B

Number of Plants

Type of Plant	1977 (BPT) Number	1977 (BPT) Percent	1983 (BAT) Number	1983 (BAT) Percent	Total Number	Total Percent
Municipal Dischargers	307	16.8%	-	- %	307	16.8%
Direct Dischargers	92	16.8	24	5.3	116	21.2
Total	399	16.8%	24	5.3%	423	17.8%

Source: Exhibits VII-5, VII-6, VII-8

It should be noted that of the total potential plant closures for Alternate A, or total potential plant closures for Alternate B, 242 in both alternates, are estimated to be the result of pretreatment standards. Pretreatment regulations have been proposed to be the same as BPT standards which is represented by Alternate B. If promulgation of pretreatment at the proposed level is effected, plant closure impact will be equal to Alternate B.

(d) Employment Effects

Based on the estimated potential plant closings and the average number of employees for each plant size, the employment effects for Alternate A and B are shown in Tables 13 and 14.

Table 13

Alternate A

Employment Effects

Type of Plant	1977 (BPT) Number	1977 (BPT) Percent	1983 (BAT) Number	1983 (BAT) Percent	Total Number	Total Percent
Municipal Dischargers	1,098	4.1%	-	- %	1,098	4.1%
Direct Dischargers	578	8.3	148	2.3	726	10.4
Total	1,676	5.0%	148	2.3%	1,824	5.4%

Source: Exhibits VII-9, VII-11, VII-12, VII-14, VII-15

Table 14

Alternate B

Employment Effects

Type of Plant	1977 (BPT) Number	1977 (BPT) Percent	1983 (BAT) Number	1983 (BAT) Percent	Total Number	Total Percent
Municipal Dischargers	1,923	7.2%	-	- %	1,923	7.2%
Direct Dischargers	578	8.3	148	2.3	726	11.5
Total	2,501	7.4%	148	2.3%	2,649	7.8%

Source: Exhibits VII-10, VII-11, VII-13, VII-14, VII-16

Of the approximately 1,824 or 2,649 employees for Alternates A and B respectively, estimated to be affected by the potential plant closures, it is estimated that about 50 percent will be re-employed in the remaining firms in the Electroplating Industry. The net effect is, therefore, an estimated displacement of 912 or 1,325 employees respectively, for Alternates A and B.

(e) Community Effects

It is believed that little or no impact on local communities will result from plant closings due to pollution abatement requirements.

(f) Production Effects

Based on the estimated potential plant closings and the average dollar sales for each plant size, the production effects resulting in decreased industry capacity for Alternates A and B are shown in Tables 15 and 16 on the following page.

Table 15

Alternate A

Production Effects

Type of Plant	1977 (BPT)		1983 (BAT)		Total	
	$Million	Percent	$Million	Percent	$Million	Percent
Municipal Dischargers	$ 21.5	4.3%	$ -	-%	$ 21.5	4.3%
Direct Dischargers	11.3	7.5	2.9	2.1	14.2	9.6
Total	$ 32.8	5.0	$ 2.9	2.1%	$ 35.7	5.5%

Source: Exhibits VII-17, VII-19, VII-20, VII-22, VII-23

Table 16

Alternate B

Production Effects

Type of Plant	1977 (BPT)		1983 (BAT)		Total	
	$Million	Percent	$Million	Percent	$Million	Percent
Municipal Dischargers	$ 37.5	7.4%	$ -	- %	$ 37.5	7.4%
Direct Dischargers	11.3	7.5	2.9	2.1	14.2	9.6
Total	$ 48.8	7.4	$ 2.9	2.1%	$ 51.7	7.9%

Source: Exhibits VII-19, VII-19, VII-21,
VII-22, VII-23, VII-24

It is believed that the majority of this potential lost sales volume in each geographic area will be shifted to the remaining plants in that area.

LIMITS OF THE ANALYSIS

(a) Accuracy

The accuracy of this study depends upon the accuracy of:

1. Published United States Government data.
2. Published industry data.
3. Unpublished information supplied by knowledgeable industry personnel.
4. Cost data provided by EPA developed separately under contact by Battelle Columbus Laboratories.
5. Estimates by Kearney personnel.

While conflicts in the published data existed, these data were judged to be reasonably accurate for a study of this nature.

The information supplied by members of the electroplating industry was assumed to be accurate, and the cost data provided by Battelle Columbus Laboratories were used as supplied.

(b) Critical Assumptions

The assumptions which directly affect the findings and conclusions of this study are:

1. All economic impact analysis is based only on the

costs of meeting the proposed effluent guidelines provided by EPA through its technical contractor Battelle Columbus Laboratories.

2. The economic impact analysis assumes that all viable firms in the industry which pass the closure analysis will be able to stay in business.

3. It was assumed that the enforcement of the effluent guideline regulations for both direct dischargers by the federal government and municipal dischargers by local authorities will be effective and establishments will not be able to operate in violation of guidelines.

4. It was assumed that industry will respond to the effluent guideline limitations as promulgated.

(c) Critical Parameter Estimates

The critical parameter estimates which directly affect the findings and conclusions of this study are:

1. Plants in each size segment have been assumed to be similar in size and production. Sales, employment and production are assumed to be relevant units of measurement for the plants in the industry. These assumptions were supported with detailed analysis in an industry survey performed by Kearney.

2. The majority of the small shops were assumed to have similar waste streams and operate in approximately the same manner according to size, as stated in the above paragraph.

3. In the absence of more accurate data, the volume of water discharged into streams versus that discharged into municipal sewers, was assumed to be representative, regardless of the location of the plants.

4. The municipal dischargers and direct dischargers were assumed to be distributed equally by geographical location.

5. The plants in the industry which are affected by pollution abatement have either zero current investment in waste water treatment equipment, or the estimated costs to meet guidelines are in addition to present costs for those plants already using some type of treatment.

6. Profitability and costs for plants discharging to municipal waste treatment systems and discharging directly to streams were assumed to be similar.

7. It was assumed that all shop owners will attempt to maximize profits. It was also assumed that five years profits would be the maximum amount of investment a shop owner would be willing to forego before going out of business.

I - INTRODUCTION

STATEMENT OF THE PROBLEM

The 1972 Amendments to the Federal Water Pollution Control Act have required the Environmental Protection Agency to establish effluent limitations for most major industries which are sources of water pollution. These effluent limitations will apply to existing and new plants, and at legislated dates progressively more restrictive limitations will be imposed. Specifically by July, 1977, effluent requirements will be in effect that require application of the best practical control technology currently available. By July, 1983, a more restrictive set of limitations will be enacted that require the application of the best available technology economically achievable; and by 1985, if possible, techniques and systems that enable the industries to effect zero level of discharge will come into effect.

In recent years, a recognition of the potential economic problems facing industry in meeting the control requirements has resulted in study programs in which the economic impact of the costs of pollution control on American industry and on the economy in general have been analyzed. These culminated in the Economic Impact Studies sponsored by the Council for Environmental Quality and the EPA in 1971 and 1972, in which 11 industries were studied.

The EPA has now increased the number of industries which are being studied, and expanded the scope of previous studies, by authorizing a series of Economic Impact Studies which are specifically aimed at analyzing the economic impact of the costs of water pollution abatement requirements under the Federal Water Pollution Control Amendments of 1972.

SCOPE OF THE STUDY

The Electroplating Industry is broadly defined as the industry which performs electrodeposition of a metallic surface onto a second base metal. Standard Industry Classification (SIC) code 3471 defines the industry as establishments which perform plating, polishing, anodizing and coloring of metallic products as the major operation of the plant.

For purposes of this study the EPA defined the Electroplating Industry as consisting of establishments which perform copper, nickel, chromium and zinc electroplating only. Plants which have other electroplating operations are considered to be in the Metal Finishing Industry and are to be included in a subsequent study.

METHOD OF APPROACH

The study involved a number of major steps to collect and review industry plant data, analyze cost information and prepare written descriptions of the industry and impact analysis.

The first task order involved 13 steps as follows:

(a) Economic Analysis of Proposed Guidelines (Task Order 1)

In performing this study, Kearney:

1. Collected and reviewed all published data and information which could be found in trade journals, government sources and A. T. Kearney files.

2. Met with representatives of the following agencies and organizations to gather additional information:

   (a) Environmental Protection Agency
   (b) National Association of Metal Finishers
   (c) Chicago Electroplaters Institute
   (d) Battelle Columbus Laboratories
   (e) U.S. Department of Commerce.

3. Conducted approximately 30 telephone interviews of electroplaters located in various areas of the United States to gather financial and operating data.

4. Analyzed all of the data collected. A list of reference sources used in this study is given in Exhibit I-1.*

5. Prepared a draft report covering industry profile.

6. Reviewed the preliminary findings and conclusions with the EPA. The results of the findings indicated that the economic impact of water pollution control costs would be greatest on electroplaters with employment of less than 100

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* All exhibits are located at the end of the section in which they are discussed.

persons. It was, therefore, decided by A. T. Kearney and the Environmental Protection Agency that the scope of the impact analysis would concentrate on electroplating establishments employing less than 100 personnel.

7. Analyzed the effluent guidelines and cost data developed by Battelle Columbus Laboratories with respect to the projected costs of water pollution control.

8. Visited approximately 25 Chicago area electroplaters and reinterviewed, by telephone, previously contacted electroplaters located in other areas of the United States to collect additional information to that gathered in step 3.

9. Interviewed five Chicago area banks to assess the ability of electroplating shops to obtain financing for pollution abatement equipment.

10. Made revisions to the original draft report as additional information became available from more recent industry studies.

11. Analyzed data and determined the impact on the industry.

12. Prepared a draft report covering the findings and conclusions of the impact analysis.

13. Combined the two draft reports from Task Order 1 covering the results of the industry profile and the impact analysis into a single report, and submitted the report to the Environmental Protection Agency.

(b) Supplemental Study to the Economic Analysis of Proposed Guidelines

The impact analysis of Task Order 1 indicated that a significant number of small electroplating shops, employing fewer than 20 persons, were subject to closure because of the effluent limitations proposed for the industry. The data used in arriving at the conclusions had been based to a large extent on electroplating plants and banks in the Chicago metropolitan area. It was determined by EPA that the data base should be expanded to include other industrial sectors of the country where electroplating plants were concentrated. Other major assumptions used in arriving at the closure rates were to be reevaluated in the supplemental study.

The six critical assumptions of the study were as follows:

1. Sales, employment and production were assumed to be relevant units of measurement for sizing the industry plants.

2. Small shops were assumed to have similar waste streams and operate in fairly similar manner according to the size parameters set forth in the study.

3. The number of plants discharging directly to streams was based on effluent discharge volumes found in U.S. Census Bureau reports.

4. Costs of meeting EPA guidelines were based on existing plants having zero or minimal investment in pollution control equipment.

5. Operating costs and profitability were assumed to be similar for all plants, irrespective of geographic location.

6. It was assumed, based on interviews, that all electroplating shop owners would raise prices sufficiently to maintain the same dollar profit rather than to absorb the cost through reduced profits. However, if unable to raise prices to the full extent required, owners would set a five-year limit on the period of reduced profits.

The objectives of the supplemental study were defined by EPA as follows:

1. Develop additional information on industry structure, relationship of sales to production volume, capital availability, profitability, and impact on captive plants.

2. Determining if the information was significantly different from that developed in the initial study and, if so, to what extent would it change the conclusions of the initial study concerning economic impact.

These objectives were met by proceeding as follows:

1. Twenty-one plants in four cities were visited and owners and principals interviewed to identify plant characteristics, financial structures, and management operating decisions which would be affected by impending pollution abatement regulation.

(a) Where data were available, differences between manual and automated plants were defined and comparison made between sales volume, number of employees and profitability of the different plants.

(b) An assessment was made of the adequacy of using sales volume as a parameter for sizing plants in terms of their ability to remain viable with the added cost of water pollution controls at the proposed levels.

2. Banks, and other potential sources of pollution equipment financing, were visited in New York, Los Angeles and Detroit, where concentrations of electroplating shops exist. This was done to:

(a) Investigate the ability of small shops to secure estimated financing requirements.

(b) Determine the cost and terms of loans from banks and SBA, to assess the capability of the shops to meet the repayment requirements set forth by these institutions.

(c) Examine the maximum number of years over which small platers would be willing to finance cost of pollution abatement equipment.

3. The initial study, Task Order 1, was reviewed to refine the overall industry profile.

(a) The number of electroplating shops was redefined along process category lines.

(b) A review was made of the method for estimating the number of shops discharging to municipal treatment systems.

4. Profitability of the industry was reassessed with particular attention focused on small electroplating shops with fewer than 20 employees.

5. A draft report was proposed to outline the findings of the field studies and bank interviews. The draft report included:

(a) Revising the data on the number of plants which plate copper, nickel, chromium and zinc.

(b) Revising Task Order 1 study data to reflect differences in conclusions regarding the following:

- Prices
- Capital availability, profits
- Production
- Employment
- Communities
- Balance of trade
- Customers, users of final goods

6. Reviewed the report findings with EPA officials.

7. Prepared a final report which integrated the findings Task Order 1 and the supplemental study into a single document.

EXHIBIT I-1
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ENVIRONMENTAL PROTECTION AGENCY

LIST OF REFERENCE SOURCES

SECONDARY SOURCES

Annual Statement Studies, Robert Morris Associates, 1972

Annual Survey of Manufacturers - 1971, U.S. Department of Commerce

Business and Economic Evaluation of the Metal Finishing Industry, Michigan Business Reports No. 52, Graduate School of Business Administration, University of Michigan

Electroplating Engineering Handbook., Graham, Reinhold Publishing Co., 1962

Census of Manufactures - 1967 and 1972 Department of Commerce

Cost of Clean Water - Industrial Waste Profile Study Motor Vehicle and Parts, November 1967, U. S. Department of Interior

Development Document for Effluent Limitations Guidelines and Standards of Performance - Electroplating Industry (Copper, Nickel, Chromium and Zinc), 1973, Battelle Columbus Laboratories,

Dun & Bradstreet Reports

Enterprise Statistics - 1967

EPA Technology Transfer Seminar Publication - #1 In-Process Pollution Abatement, July 1973 -- #2 Waste Treatment July 1973, Environmental Protection Agency

Finishers Management - National Association of Metal Finishers

Industrial Water Engineering

Metal Working Market Guide 1972, Iron Age

Metals Handbook, Volume 2, American Society for Metals, 1964

EXHIBIT I-1
Page 2 of 2

Moody's Industrial Manual

Predicast, Market Forecasts

PERSONAL INTERVIEWS

(a) Electroplaters

A. T. Kearney industry survey of 62 independent and captive electroplaters.

(b) Banks

A. T. Kearney survey of 13 banks in Chicago and in other cities.

(c) Others

American Electroplaters Society
East Orange, New Jersey

Dr. Fred Gurnham, Consultant, Chicago,
Chicago, Illinois

Mr. Scott Modjeska, Consultant
Chicago, Illinois

National Association of Metal Finishers (NAMF)
Upper Montclair, New Jersey

- Also 15 local chapters NAMF

II - GENERAL INDUSTRY DESCRIPTION

This section of the report provides a general insight into the operations of the Electroplating Industry. Included is a broad description of the nature of the demand for electroplating and how other industry segments affect the viability of the Electroplating Industry. A general description of the processes involved and the sources of water pollution are also discussed. The major headings of this section are:

- Demand Characteristics for Electroplating
- Substitutes for Electroplating
- Description of the Plating Process
- Sources of Water Pollution

DEMAND CHARACTERISTICS FOR ELECTROPLATING

Electroplating is an electrochemical process performed on manufactured parts when the original surface characteristics of the base metal used to form or manufacture the product does not possess desired surface characteristics. Some examples of the desired finishes would be corrosion protection, hard or durable finishes, bright or decorative characteristics, and electrical conductivity.

Primary demand for the electroplating process is governed largely by the technical requirements of the industry segments which manufacture the end products. For example, toolmakers require a hard chrome finish to provide durability to the finished product. Manufacturers of household products require decorative finishes. Zinc or cadmium finishes are specified for corrosion resistance.

Although it is exceptionally difficult to provide accurate estimates of the total demand for electroplating, it is possible to provide a general indication of the extent of usage of electroplating in other industry segments. By understanding this broad industry dependence on electroplating, it is then possible to understand some of the factors which can affect the demand for the electroplating service.

Exhibit II-1 depicts the types of finishes required in nine different two-digit SIC code industry segments. Approximately 200 four-digit SIC code industry groupings and over 100,000 establishments are represented by this listing. Of these, between 20,000 and 30,000 establishments are estimated to have installed or purchased services for metal finishing operations. This number of establishments and industry groupings is extremely large, and represents a diverse market for electroplating services.

A limited number of estimates have been made about use of materials by the industry. For example, Predicast, a market forecasting publication, provides estimates of consumption of chromic acid, which is expected to grow at approximately 2.5% per year until 1974. It is also estimated that the consumption of nickel for nickel plating will increase from 47 million pounds in 1971 to 66 million pounds by 1976. Sales of nickel plating are predicted to increase at an annual growth rate of 6% over the period 1972 to 1978.

Clearly, the demand for electroplating is broad and used in a wide range of industries. It is also expected that the industry demand will continue to grow, probably consistent with the growth of segments which are major users of the service.

SUBSTITUTES FOR ELECTROPLATING

A major factor which must be considered in estimating demand for a product or service is the availability of substitutes. Electroplating, as previously described, imparts a metal surface characteristic onto another metal or plastic base. The base material is almost always less expensive per pound than the surface metal being deposited. By plating on a less expensive base material, the finished surface of the product takes on the desired characteristic of the more expensive metal at lower total costs than would be possible if the product were fabricated entirely with the plated metal or a similar metal with the characteristics of the plate. A viable substitute would have to have either an improved characteristic or lower costs. Neither seems to be the case for most electroplated products. Other processes either are less desirable aesthetically, or technically, or are more expensive.

The use of other less expensive and less polluting plating metals is not always possible for technical reasons. For example, copper must be applied to some metals as a base for subsequent chrome plating. Suitable substitutes have not been found to perform as satisfactorily and as cheaply as copper.

Chromium is used in plating primarily because of its hardness and its bright and durable finish. Other products are not considered viable substitutes because they lack the same technical specifications as chromium.

Although paint is a possible substitute for some plated surfaces, industry sources have not indicated that a rapid subsitution will take place. Products which are generally exposed to the atmosphere for prolonged periods tend to be plated rather than painted because of the durability of the plating versus the paint. Automotive products are also continuing to be plated for decorative purposes, and plating has not been replaced to a great extent by painted surfaces in the automotive industry.

Plastics have replaced some base metals; however, in some cases even the plastics are plated for decorative or conductive purposes. However, plating is more difficult and expensive on plastics than on the base metal surfaces which were replaced, even though the combined cost of plating and base material may be lower.

Stainless steel is another possible substitute for base metals which are plated to prevent corrosion. However, since the cost of stainless is far greater than a less expensive base metal plus the plating, it is doubtful that stainless products will replace plated products.

Although some substitutions may actually occur if prices of plating increase substantially, it is the opinion of many in the industry that the effect will be minimal and will not substantially affect the overall demand for electroplating. Substitution over the long term will also be limited unless price increases foster the development of new substitute technology not now foreseen.

DESCRIPTION OF THE PLATING PROCESS

(a) Equipment Used

The equipment requirements in the electroplating process depend upon the physical dimensions of the workpieces being plated. Barrel and still plating are the two primary methods in heavy commercial use.

Many types of barrel finishing equipment are used. Each type essentially consists of a cylinder or barrel which contains the parts being plated, and a tank filled with the plating solution. The barrel is placed in the plating tank and is rotated in the solution. An electrical current is discharged through the barrel to the parts in the plating solution resulting in deposition of metal from the solution on the parts being plated.

Typically, still plating methods involve the use of special frames or racks which hold the parts in place during the plating process. The racks also serve the function of carrying electrical current to the pieces in the plating tanks.

(b) Materials Used

Raw material needs for the simple electroplating operation are relatively small. Preliminary treatment is performed with the use of acid dips, water, and special cleaning solutions, before the actual plating is done. While hundreds of different plating solutions are available commercially, cyanide, alkaline and acid sulfate solutions are among the most popular. Water is used in great quantities in the rinsing cycles of the electroplating process.

Differences in the selection of various methods of pretreatment of metals are explained to a large extent by the specific properties of each metal and preference for one method over another when a choice is available. For example, sulfuric acid pickling alone is generally considered unsatisfactory for oxide removal from stainless steels and corrosion-resistant alloys because black smut is left on the workpiece. Sulfuric acid, however, is a good pickling agent for the copper-rich alloys. Similar situations exist in other plating processes.

(c) Process Flow

A simple electroplating process generally includes four sequential operations--cleaning, plating, rinsing and drying.

The cleaning step is performed to prepare the piece for plating by removing all foreign matter such as oil, grease, dirt and oxide that could retard or prevent the plate from adhering to the workpiece surface. Abrading, pickling, and other preliminary treatment is often necessary, followed by rinsing to remove the pretreatment solutions. Rinsing is necessary to enhance surface adhesion and to avoid contamination of plating solutions. All workpieces are rinsed at the end of the plating process before being allowed to dry, to avoid spotting.

SOURCES OF WATER POLLUTION

Rinsing solutions are the major sources of water pollution in the electroplating process. Toxic substances which accumulate in the rinse water or are used in the plating solutions find their way to sewage systems and streams by a variety of means:

1. Accidental spillage or tank leaks.
2. Intentional dumpings.
3. Drag-out from one tank to another.
4. Losses due to the periodic cleaning and repacking of filters.
5. Vapor sprays or mists drawn off by the ventilation system.

Closer supervision over the electroplating process serves to reduce accidental spillage and leaks, toxic vapors, and losses from the cleaning of filters. Drag-out, however, is a more difficult and continuous problem resulting from the transfer of racks or barrels from one solution to another and is the major source of pollution. Intermediate rinsing solutions become contaminated with solutions from previous tanks, necessitating periodic dumpings. However, the volume of plating and the type of process used are important elements in determining the amount of pollution.

EXHIBIT II-1

ENVIRONMENTAL PROTECTION AGENCY

Economic Impact of Pollution Abatement On The Electroplating Industry

End Uses of Electroplating by Industry Segments

SIC Code	Industry Classification	Type of Finish: Durability	Decorative	Conductivity	Corrosion Protection
19	Ordnance	X			X
25	Furniture and Fixtures		X		X
33	Primary Metal Industries		X	X	X
34	Fabricated Metal Products	X	X	X	X
35	Machinery Except Electrical	X	X		X
36	Electrical and Electronic Equipment		X	X	X
37	Transportation Equipment	X	X	X	X
38	Instruments and Related Parts	X	X	X	X
39	Miscellaneous Manufacturing Industries	X	X	X	X

Source: Metal Working Market Guide

III - PHYSICAL CHARACTERISTICS OF THE INDUSTRY

In this section of the report physical characteristics of the Electroplating Industry are discussed in order to determine the major market segments expected to be significantly impacted by pollution control standards. These are discussed under the following topic headings:

- EPA Industry Categorization
- Establishments Versus Installations
- Independent Versus Captive Operations
- Size of the Industry
- Industry Survey
- Types of Firms
- Categorizing the Industry
- Expected Impact by Industry Segments
- Size of Plants in Impact Analysis
- Location of Impacted Shops
- Analysis of Industry by Point of Discharge

EPA INDUSTRY CATEGORIZATION

The Electroplating and Polishing Industry as covered by SIC 3471, was segmented by the EPA into two major groupings for purposes of effluent limitations analysis and economic impact analysis. The two groups consisted of:

1. Establishments which perform copper, nickel,

chromium, and zinc plating as a principal service.

2. Establishments which principally plate other metals, and establishments which principally provide anodizing, coloring, and polishing services.

The first of these groupings includes the establishments which are the subject of this impact assessment. Establishments in this segment of the industry fall entirely within SIC 3471.

ESTABLISHMENTS VERSUS INSTALLATIONS

Electroplating operations can be classified into two major categories:

1. Electroplating "Establishments." These are separately operated establishments(*) whose primary activity is

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(*) The Standard Industrial Classification definition of "establishment is "an economic unit, generally at a single physical location where business is conducted or where services or industrial operations are performed. (For example: a factory, mill, store.)

Where distinct and separate economic activities are performed at a single physical location (such as construction activities operated out of the same physical location as a lumber yard), each activity should be treated as a separate establishment wherever (1) no one industry description in the classification includes such combined activities; (2) the employment in each such economic activity is significant; and (3) reports can be prepared on the number of employees, their wages and salaries, sales or receipts, and other establishment type data.

An establishment is not necessarily identical with the enterprise or company which may consist of one or more establishments. Also, it is to be distringuished from subunits, departments or divisions. Supplemental interpretations of the definition of an establishment are included in the industry descriptions of the Standard Industrial Classification where appropriate."

the production of electroplating services. These may be independent (job) shops which sell their services in the marketplace to numerous metalworking industries or they may be owned by a company (captive) and operated for their own use without selling to outside customers.

2. Electroplating "Installations." These are installations in an establishment primarily engaged in another industry. By their nature they are "captive" and are typically integrated into the production processes of the products which the plant is producing. These installations represent a small portion of the employment and value added in relation to the total operations of these plants.

This study covers only electroplating establishments which principally plate copper, nickel, chromium and zinc. These are in the first category above and include both independent and captive establishments which are covered by SIC 3471. This includes all firms which typically offer electroplating services for sale in the marketplace.

This study does not cover electroplating "installations" as described in the second category. Services provided by these captive installations represent a significant portion of the total electroplating operations conducted by industry. Kearney survey interviews indicate that these installations produce on the order of 50% of the total volume of electroplating. While these operations are not included in the economic impact assessment a brief summary of the characteristics of captive installations owned and operated by the specific industries requiring this service appears in Appendix A - In-Plant Electroplating Process Installations.

INDEPENDENT VERSUS CAPTIVE OPERATIONS

"Independent" operations are those which offer commercial services in the marketplace. "Captive" operations are those which are owned and operated by a business for their own internal use and any sale of commercial services is incidental. Both independent and captive establishments are included in the study. These should not be confused with captive in-plant process assessment of installations which are not covered by this study.

SIZE OF THE INDUSTRY

(a) Industry Statistics

The Electroplating and Polishing Industry, as defined by Standard Industrial Classification (SIC) 3471, consists of separate establishments primarily engaged in electroplating, polishing, anodizing, and similar activities. Industry statistics, as reported in the Census of Manufactures for 1958, 1963, 1967, and 1972, are given in Exhibit III-1. During the 14 year period covered by these statistics, the number of establishments in the industry increased from 2,646 in 1958 to 3,241 in 1967, and dropped to 3,220 in 1972. The number of employees increased from 36,500 in 1958 to 55,100 in 1967, and dropped to 53,300 in 1972.

The industry is primarily composed of small establishments, with more than 75% having fewer than 20 employees. The average number of employees per establishment increased slightly from 14 in 1958 to 17 in 1972. However, the business done per establishment has grown, with average value added by manufacturing increasing from $96,000 in 1958 to $233,000 in 1972, an increase of 243%, while the index of cost of durable goods increased by 123.9% during that same period. Another measure of growth is electric power consumption, which increased from 195,000 KWH per establishment in 1958, to 488,000 KWH in 1972, an increase of 250%.

In the following paragraphs, the industry is further analyzed. The balance of the report is based on the 1967 Census of Manufactures data, since the 1972 Census data were incomplete and preliminary and represented relatively little change from 1967 in number of establishments reported.

(b) Number of Total Establishments

Table III-1 shows the total number of electroplating, polishing and anodizing establishments which are included in Census studies for SIC 3471.

Table III-1

Plating and Polishing Establishments

Year	Number of Establishments
1967	3,241
1972	3,220

Sources: U.S. Department of Commerce Bureau
of Census, 1967, 1972

Because the scope of this study included only electroplating establishments principally plating copper, nickel, chromium and zinc, it was necessary to refine the data since all processes included in SIC 3471 were not to be covered by effluent guidelines. Plants excluded from this analysis are to be included in a separate Metal Finishing Industry study. The relevant number of establishments in the Plating and Polishing Industry under SIC Code 3471, which this study covers is shown as the copper, nickel, chromium and zinc group in Table III-2. Because the 1972 Census data were incomplete and preliminary at the time of writing this report and represented little changes from 1967, the data reported in the 1967 Census was used for industry analysis.

Table III-2

Plating and Polishing Establishments

(All Sizes)

Type of Establishments	Number of Establishments
Copper, Nickel, Chromium, Zinc	2,423
All Others	818
Total Establishments	3,241

Sources: A. T. Kearney Estimates
1967 Census of Manufactures

The table indicates that approximately 75% of all SIC Code 3471 establishments are copper, nickel, chromium or zinc platers. Establishments included in the "All Other" group consist of anodizers, precious metal platers, cadmium platers and other electroplating types to be covered in the separate Metal Finishing Industry study.

(c) Employment in All Plants and Installations

The total number of employees reported in the 1967 Census of Manufactures report for establishments in the Plating and Polishing Industry were 55,100.

The number of employees in the industry was defined to provide data on establishments plating various metals. Table III-3 shows how employment is distributed between the copper, nickel, chromium and zinc plating establishments and other segments of the industry.

Table III-3

Industry Employment

SIC Code	Type of Establishments	Number of Employees
3471	Copper, Nickel, Chromium, Zinc.	42,331
3471	Other Electroplating and Coating	12,769
	Total	55,100

Source: U.S. Census of Manufactures, 1967
Metalworking Market Guide, 1972
A. T. Kearney Estimates

INDUSTRY SURVEY

The limited data available from Census studies required that additional information be compiled for use in the impact analysis phase of the study. These data were obtained in an independent survey of the industry performed by A. T. Kearney during the course of this study.

Exhibit III-2 is a summary of information gathered from 59 electroplating shops. The data provide a basis for many assumptions used in the analysis of the industry and the effects which pollution controls are expected to have on electroplating establishments. Particular emphasis on characteristics such as size, diversification, plant location, sales volume and production constraints were of concern to determine the relative degree of impact on the industry.

(a) Sales

Annual sales per establishment range from $25,000 to $8 million. However, most of the shops surveyed reported annual sales of less than $1 million. Although no definite conclusions can be drawn from the small sample, these shops are typically small businesses, operating on relatively small annual sales volumes.

(b) Survey and Industry Employment

Electroplating establishments are small in terms of employment, as indicated by the survey data and Census information. Ninetyfive percent of the shops have employment of less than 50 persons, but only 60 percent of total employment is in these shops.

TYPES OF FIRMS

Electroplating shops can be segmented in the following categories:

- Sizes of Establishments
- Types of Plating Performed
- Integrated Firms
- Multiplant Firms
- Single or Multiple Product Firms
- Highly Diversified Firms
- Specialists
- Automatic Versus Manual Operations

The relevance of segmenting firms by these subcategories is discussed in the following paragraphs:

(a) Sizes of Establishments

The most important basis of segmentation has been determined to be size of establishment. The only complete source of data for segmenting firms by size is the U.S. Census of Manufactures reports. The last year for which this data has been published is the 1967 Census. Although these data are now seven years old, an analysis of the 1972 preliminary Census data has shown that very little change has taken place in the Plating and Polishing Industry between 1967 and 1972. The number of establishments dropped slightly from 3,241 in 1967 to 3,220 in 1972. Number of employees dropped from 55,100 in 1967 to 53,300 in 1972. Average employees per establishment dropped from 17 to 16.5. These small changes in the industry did not justify any significant redistribution of establishments by size, therefore the 1967 data have been used.

Table III-4

Sizes of Establishments
Cu, Ni, Cr, Zn Platers

Employees Per Establishment	Number of Establishments		Number of Employees	
	Number	Percent	Number	Percent
1 - 4	924	38.0	1,871	4.4
5 - 9	426	17.6	3,017	7.1
10 - 19	433	17.9	6,130	14.5
20 - 49	463	19.2	14,065	33.3
50 - 99	128	5.3	8,666	20.5
Over 100	49	2.0	8,582	20.3
Totals	2,423	100.0	42,331	100.0

It is of interest to note that although small establishments as represented by shops with fewer than 20 employees represent 73.5 percent of total establishments, they only account for 26 percent of total employment. Conversely, large establishments with over 50 employees only represent 7.3 percent of total shops, but account for 40.7 percent of total employment. A further analysis of Census data has shown that the distribution of value of shipments by size of firm coincides almost exactly with employee distribution, with firms of under 20 employees accounting for 25.3 percent of value of industry shipments, and firms of over 50 employees accounting for 41.3 percent of value of shipments.

(b) Types of Plating Performed

Classification of the electroplating establishments covered by this study by principal type of plating service performed was made, based on an extension of data reported in the 1972 edition of Metalworking Market Guide, published by Iron Age Magazine. In this publication, a 6-digit SIC classification was given which separated establishments by principal type of plating service which was performed. Since only establishments of over 20 employees in size were covered in the analysis, it was necessary to extend the data to cover the smaller establishments. In carrying out this extension, the assumption was made that the distribution by process was the same for small firms as it was for large ones. The resultant segmentation of establishments by principal plating service performed is given in Table III-5 on the following page.

Table III-5

Estimated Distribution of the Industry Establishments By Type of Plating

Type of Plating	Number of Establishments	Employment
Electroplating (Unspecified)	1,078	17,551
Chromium	796	14,825
Nickel	231	4,262
Copper	318	5,693
Totals	2,423	42,331

Sources: A. T. Kearney, Estimates and
Iron Age Metalworking Market Guide, 1972.

The unspecified plating shops are believed to principally include zinc platers, but also undoubtedly include platers of other metals such as copper, nickel, chromium, cadmium, tin and lead. However, for lack of any means for further breakdown they were all included in this study.

Based on data submitted in the effluent guidelines study for the Electroplating Industry, no cost differences were reported for different processes of plating. Therefore, processes employed were not considered to be a significant factor in impact evaluation and were not used for this purpose in the impact analysis in this study.

(c) Level of Integration

In almost all cases, establishments in the Electroplating Industry perform more than a single type of service. For example, buffing and polishing operations are carried out in almost every shop. Many shops also provide pickling services and other surface preparation operations. Similarly, in almost all cases more than one type of plating service is performed in the same shop.

As previously indicated, the effluent guidelines document made no distinction in costs for type of process or number of processes employed. Therefore, we have not used level of integration as a factor in assessing impact of pollution control.

(d) Multiplant Firms

A small number of electroplaters operate as multiplant firms. The 1967 Census of Manufactures report identified 197 establishments of 3,241 total in the Plating and Polishing category as multiplant companies. These establishments employed 10,600 workers, or an average of 54 per establishment. In practically all cases, these multiplant firms operate shops which were classified as large, with more than 50 employees. In view of the fact that even a two shop company would probably have 100 or more total employees, we believe that the multiplant firms will all fall within the large company category, and will be impacted by requirements for pollution control.

(e) Number of Products

Industry sources indicate that little relationship exists between the number of products plated and the extent of pollution problems. A more relevant measure would be the physical shape of the product, since products which drain poorly create greater drag-out problems. Consequently, they are greater sources for pollution. It would certainly be desirable to identify shops which have the major drag-out problems caused by the product design. However, industry data are not compiled in this manner. The number and type of products which are plated in a shop has not been determined to be a significant factor in the impact analysis.

(f) Level of Diversification

The Electroplating Industry is dominated by shops which have more than a single plating process. This is caused by the need to maintain multiple plating lines to provide full services to customers.

A study of the National Association of Metal Finishers (NAMF) members indicates that approximately 15 percent of the shops are specialists. Although a shop may be classified as a specialist, technical requirements could require more than one plating process. For example, a decorative chromium plater of metal products must also perform copper and nickel plating prior to the final chromium finish. In effect, this shop would be a multiple plating plant. It is important to recognize the number of plating processes existing in plants within the industry. Multiple waste stream plants would be expected to create a more complex pollution control problem and probably higher costs than single stream plants. Although it would be desirable to subsegment the industry according to the level of diversification which could give some indication of the number of waste streams, data are not available for making such a distribution.

(g) Automated Versus Manual Firms

Consideration has been given towards segmenting the industry according to the degree of automation. Similar to problems encountered in defining the industry by other characteristics, the number of automated shops versus manual shops is not available from known studies. However, based on limited studies during field visits to several industrial areas, some characteristics of the automated shops can be provided.

Four shops studied during the field investigation had automated equipment. None were fully automatic, and three of them employed more than 40 plating employees and had annual sales exceeding $1,000,000. Table III-6 summarizes the important characteristics of these shops.

Table III-6

Characteristics of Selected Automated Shops

Plant Number	Percent Automated	Number of Employees	Annual Sales Volume
6-43	33%	62	$1,900,000
6-44	15	109	1,900,000
6-46	50	20	300,000
6-56	70	45	1,400,000

Source: A. T. Kearney Survey

It would not be practical to extrapolate from the small field sample the extent to which automation exists in the industry. However, industry sources indicated that very few small plants are automated. Automation tends to be more extensive in larger shops with over 40-50 employees. Large amounts of capital are required to install automatic plating equipment and limited capital availability in smaller shops is the primary reason automation does not exist in this segment of the industry.

Labor economies are experienced in some shops where automated plating is performed. However, analysis of financial data has not indicated that profitability increases because of automation. This may be due to higher operating costs of automated equipment. Interest, depreciation, set-up costs, and maintenance tend to offset some savings in direct labor costs. Automation tends to be more extensive in larger shops with over 40-50 employees. Large amounts of capital are required to install automatic plating equipment, and limited capital availability in smaller shops is the primary reason automation does not exist in this segment of the industry.

Labor economies are experienced in some shops where automated plating is performed. However, analysis of financial data has not indicated that profitability increases because of automation. This may be due to higher operating costs of automated equipment. Interest, depreciation, set-up costs, and maintenance tend to offset some savings in direct labor costs. Automation does permit higher sales volumes because of capability of handling larger runs and higher production rates. This capability attracts customers who have high volume requirements. Therefore, these shops may compete in an entirely different market than strictly manual shops. Automated plating lines require longer production runs to justify captial investments for the equipment. Because of this, plants planning to install automated lines must either have large volume customers, or have plans to change their markets by seeking the large volume buyer. Small plating plants generally do not have sales personnel necessary to develop additional or different markets; consequently, unless their present customers' plating requirements change, the small shops usually cannot justify, or risk, changing their operations from manual to automatic lines.

Table III-7 compares production factors between an automated plating line and a manual operation in one of the plants visited.

Table III-7

Operating Comparisons

Automated Versus Manual Plating Lines

	Type of Operation	
	Automated	Manual
Employees	12	9
Direct Hours	1,877	1,031
Millions of Pounds	3.5	1.4
Pounds/Hour	1,866	1,332
Sales/Man-Hour	$485	$378

Source: A. T. Kearney Survey

CATEGORIZING THE INDUSTRY

(a) Alternate Methods of Categorization

The effluent guidelines development document for the Electroplating Industry identified volume of effluent which is discharged as the controlling factor in sizing of electroplating establishments for pollution control regulatory purposes. However, this is a difficult characteristic to measure in most plants, and therefore, other means are required to identify plating shops by size so that pollution control requirements can be determined in a simple and direct manner. The alternate methods which have been either proposed or suggested for accomplishing this purpose are:

1. Volume of production as measured by number of pieces, weight of pieces, or square feet surface plated.

2. Capacity of shop as measured by ampere rating of rectifiers or generators used to provide plating electric current.

3. Size of establishments as measured by number of employees or annual volume of business.

An example of the application of these methods of categorization is the small shop exemption which has been applied to plating establishments. Shops which plate less than 33 square meters per hour (360 square feet), or which have under 2,000 amperes of rectifier or generator capacity, are classified as small shops which qualify for the small shop exemption.

The merits and disadvantages of each of the methods of categorization have been considered, and a suggested method which can be easily applied is discussed herein.

(b) Categorization by Volume or Area of Production

The Electroplating Industry is highly diverse and serves a large number of industries with a myriad of products. Each product may have a different physical shape and plating requirements, consequently classifying productive output by units of products is not practical. Although a product can be measured and the surface area determined, this information is generally not available. Shops studied during field visits indicated that this information is not commonly collected or easily obtained in daily operations. Electroplaters are primarily concerned with the productive capacity of the plant in terms of barrels, or racks produced per hour, rather than area covered. Obviously the surface area in a barrel or on a rack can vary significantly depending on the shape and size of the parts being plated. Since a typical shop may plate different mixes of parts daily, there could conceivably be wide ranges of surface areas plated as the product mixes change.

There is good evidence to indicate that the amount of production in a shop in terms of square feet of surface plated may have little relationship to the number of employees or the sales volume. For example, two shops, each plating 200 ft.^{2} per hour of zinc, could be plating barrels of fasteners in one plant and racks of castings in another. The labor needed to rack, plate, and unrack parts could easily be twice the labor needed in the barrel plant. Because labor is the critical variable, pricing will reflect the differences. Consequently, sales volume and employment would be higher in the rack plating plant.

Because of the diversity of products and processes serviced by the Electroplating Industry, very little comparison could be made between two plants in terms of units produced, unless the products were uniformly priced according to the area plated.

For example, a plant plating 200 ft.^{2} per hour of flat or simple shaped parts would probably not be comparable to another plant performing 200 ft.^{2} per hour of engineering plating where parts have irregular shapes, or require critical masking and other preparatory work to meet exact plating specifications.

In view of all of the variables and problems associated with determination of area of work plated, it is recommended that this method not be used as a means of determining capacity of plating shops for economic assessment of pollution control requirements.

(c) Capacity Measured by Ampere Rating

Connected electric power capacity, in terms of amperage of rectifier or generator size, can be used as a means of determining plating shop size. However, it must be recognized that power requirements will vary considerably with the type of plating which is being performed, resulting in a shop with 2,000 amperes of capacity being able to plate about 600 square feet of zinc or copper per hour, but only 125 square feet of nickel, and under 100 square feet of decorative chromium.

The age and type of power conversion equipment available will also be a variable, with the older shops using motor-generator sets and the newer shops using rectifiers. Old shops require greater current carrying capabilities than the new shops to accomplish the same level of plating. Small shops generally have a higher proportionate amount of generator or rectifier capacity than large shops to be able to handle the greater diversity of work which they often have to handle.

It is believed that although electric current capacity can be easily determined in a shop, this does not represent the most reliable way in which true shop capacity can be determined.

(d) Categorization by Value of Sales of Establishment

Reducing the amount of pollutants generated by plants in the industry has cost implications and will affect the economics of the firms involved. Therefore, it seems more relevant to categorize the industry by economic factors, than by the physical parameters; e.g., units of output, types of products or degree of diversification. Increased costs will probably cause prices to rise and possibly affect profits and capital structures, while physical characteristics may be unaffected. Therefore, categorization for economic analysis should consider economic factors rather than physical factors.

The level of sales of plants in the industry is a practical method for categorizing and assessing viability in view of increased costs due to pollution. Production factors can be related to sales if it is assumed that each employee in a manual shop has a given level of output in sales dollars. There is a reasonably good direct relationship between the amount of sales and the number of employees. Exhibit III-3 shows this relationship for plants surveyed during field investigations.

It is understandable that sales volume varies in direct relationship to numbers of employees. Interviews of plant owners disclosed the following relationships exist between sales and employees:

1. Industry pricing is primarily labor based; as more man hours are required, the price of plating increases.
2. Relatively few products are priced on basis of materials or equipment. The exception may be for hard chromium and expensive metals, such as silver and gold.
3. Support operations, such as buffing and polishing, add to the cost of the service. If products require extensive mechanical cleaning, the added labor, plus overhead, increases the sales volume.
4. Small electroplating plants are labor rather than capital intensive operations.

If value of sales is used as a basis for industry segmentation for pollution impact assessment, it must be recognized that periodic adjustments will have to be made to take into account the inflationary factors which affect costs of doing business, and also the increased costs due to pollution control requirements. If this is done, value of sales for establishments is an acceptable method of categorizing for purposes of evaluation of impact of pollution control requirements.

(e) Categorization by Size of Establishment

The most available and reliable information regarding plating shops is the number of employees per establishment. A direct correlation has been established between annual value of sales and number of employees for most shops. As shown in Exhibit III-3, the annual sales averages about $28,000 per employee for establishments in the range of 2 to 50 employees which perform the type of plating operations covered by this study. Overall industry averages per employee, as reported in the 1972 Census of Manufactures, have been lower--about $20,000 per employee. However, this includes establishments which perform services which are lower priced such as anodizing, phosphatizing and polishing.

It is recognized that certain types of establishments will be operating under conditions which will change the average relationship between value of sales and number of workers. For example, shops with automated plating equipment will use fewer workers in relation to the value of sales than shops with manual equipment. Also, shops which perform decorative chromium plating also have a higher value of sales per worker. However, on an industry-wide basis we believe that the number of employees is the simplest and most accurate method of segmenting the industry for pollution impact assessment.

EXPECTED IMPACT BY INDUSTRY SEGMENTS

Based on the previous discussions, our interviews and other analyses, we believe the impact of pollution abatement will principally be significant in the small shop of the industry. The major adverse effect will be in the small shop segment for the following reasons:

1. A greater number of small shops exist.
2. Large shops generally have a larger organization capable of supporting additional operating costs for pollution control.
3. Ability to raise necessary capital requirements for equipment is greater in the large shops.

It is expected that the large shops will be impacted but not as severely as the small shops, particularly at the lower employment levels. The Kearney survey data in Exhibit III-2 indicated:

1. Low sales volume for small shops, thus indicating insufficient cash flows for purchasing expensive control equipment.
2. Constraint on physical plant space, particularly for urban located plants, possibly necessitating additional land and building to house control equipment. This will add to the capital requirements.
3. Diversification is high in the small shops in order to hold customers. This may require added pollution control system elements to handle the wider range of wastes which are produced.

SIZE OF PLANTS IN IMPACT ANALYSIS

Plants were defined by size according to employment and sales volume. Plants with less than 100 employees are expected to have problems of meeting pollution regulations because of relatively low sales volumes and low degree of capital strength. This group will be covered in detail in the impact analysis.

Most plating shops are diverse operations with an average of three plating processes and costs of waste stream treatment have been based on this assumption. Plants expected to be impacted are listed in Table III-8. Plants in the unspecified plating category include not only zinc platers, but others which would have similar treatment methods as for plating zinc. Plants in this group would be required to perform the following:

1. Destroy cyanides.
2. Neutralize the acids or alkalis.
3. Remove heavy metals and sludge.

(a) Number of Shops Covered by Impact Analysis

Table III-8 shows the number of plants and employment in these plants which are included in the impact analysis. These data exclude plants which employ more than 100 employees and plants expected to be included in the Metal Finishing study.

Table III-8

Size of Industry Covered by Impact Analysis

	Number of Plants	Employment
Electroplating Not Specified	1,058	14,035
Chromium Plating	782	12,433
Nickel Plating	226	3,294
Copper Plating	308	3,962
Total	2,374	33,749

Source: A. T. Kearney Estimates
Iron Age Metalworking Market Guide

A total number of 867 plants and plating installations with 21,351 employees have been eliminated from the total plants and employment shown in Tables III-2 and III-3. The eliminations are based on the following:

1. A total of 49 plants with 8,582 employees have over 100 employees each. This group is not expected to be impacted.

2. A total of 818 plants with 12,769 employees are plants which plate other metals and will be covered in the metal finishing study.

LOCATION OF IMPACTED SHOPS

Electroplating shops are located in nearly all fifty states, the major concentration is in the principal industrial areas in the midwest, northeast and the west coast.

Exhibit III-5 shows the location of all types of plating and coating shops covered by SIC 3471. The location of the shops included in this analysis is estimated to be similar to the whole, since markets are not expected to vary significantly by type of plating in the relevant categories.

Geographical segmentation is important, expecially in areas where relatively few shops exist. The impact of pollution control requirements on the Electroplating Industry may be mitigated in locales where platers face protected markets. Industries in those areas depend upon the existence of these shops for plating services. Therefore these customers will tend to support the local shops and will be more likely to be willing to pay higher costs for plating services.

ANALYSIS OF INDUSTRY BY POINT OF DISCHARGE

The industry plants are principally located in urban areas and discharge effluents to municipal sewer systems. However, a number of plants are located in rural areas and discharge directly into streams, lakes, storm sewers or other waterways. Plants have been segmented into two groups based on analysis of census data. These data quantify the volumes of water discharged to municipal waste systems and to points other than municipal systems. The studies indicated that approximately 77 percent of the industry discharges to municipal systems and the balance to streams or other waters. These data were used in the impact analysis in Section VII.

In a survey of 191 National Association of Metal Finishing member plants, 75 percent of the plants indicated their point of discharge was to municipal sewer systems. The data presented in the following table give support to the decision to employ census data to distinguish between direct dischargers and municipal dischargers.

Table III-9

Summary of Waste Stream Disposal Methods by NAMF Plants

	Number of Plants	Percent of Total
Municipal Sanitary Sewer	143	75
Storm Sewer	24	12
Land Disposal	5	3
Lagooning	3	2
Natural Lakes, Streams	10	5
Others	6	3
Total	191	106

Source: EPA Report 12210 E/E 03/71

EXHIBIT III-1

ENVIRONMENTAL PROTECTION AGENCY

ELECTROPLATING, POLISHING - SIC 3471
STATISTICS OF THE INDUSTRY

Year	1958	1963	1967	1972
Number of Establishments	$ 2,646	3,023	3,241	3,220
Establishments over 20 Employees	542	677	855	795
Establishments under 20 Employees	2,104	2,346	2,386	2,425
Number of Employees	36,500	45,000	55,100	53,300
Value Added by Manufacturing (Millions)	$253.8	$370.2	$574.8	$ 749.1
Value of Shipments (Millions)	$359.1	$517.6	$791.1	$1,045.0
Capital Expenditures (Millions)	15.9	20.0	$ 33.1	$ 41.0
Value of Assets (Millions)	N.A.	$191.7	307.3	N.A.
Electric Power Consumed (Million KWH)	515	661	893	1,570
Water Intake (Billion Gallons)	N.A.	5.0	7.5	N.A.
Averages per Plant				
Average Number of Employees	14	15	17	17
Average Value Added	$ 96,000	$123,000	$177,000	$233,000
Average Value Shipments	$136,000	$171,000	$245,000	$325,000
Average Capital Expenditure	$ 6,000	$ 6,600	$ 10,200	$ 12,700
Average Value of Assets	N.A.	$ 63,413	$ 94,813	N.A.
Average Electric Power Consumed (KWH)	195,000	219,000	275,000	488,000
Average Water Intake (Thousand Gallons)	N.A.	1,650	2,310	N.A.

Source: U.S. Census of Manufactures Reports,
1958, 1963, 1967, 1972

ENVIRONMENTAL PROTECTION AGENCY

ELECTROPLATING INDUSTRY

INDUSTRY SURVEY SUMMARY

Data Item:	Company Identification Number 1	2	3	4	5	6
Urban or Rural Location	Urban	Urban	Urban	Urban	Urban	Urban
Job Shop or Captive Shop	Job Shop	Job Shop	Job Shop	Job Shop and Some Captive	Job Shop	Job Shop
Corporation or Other	Corporation	Corporation	Corporation	Corporation	Corporation	Corporation
Number of Years in Business - Company/Owner	18/40	7/-	33/25	13/-	13/20	9/30
Total Square Feet/Plating Square Feet	17,000/ 8,000	10,000/ 6,000	35,000/ 30,000	18,000/ 8,000	7,000/ 6,000	8,500/ 10,000
Total Employees/Plating Employees	25/18	10-12/8	30/15	35-40/8	7/4	8/6
Plating Lines (Percent of Sales)-						
Nickel	5%	100%	5%	-	50%	-
Chrome	95%	-	-	-	-	-
Zinc	-	-	70%	-	-	-
Copper	-	-	20%	-	Minor	-
Cadmium	-	-	5%	-	-	-
Other	-	-	Brass, Tin, Silver	-	Gold, Silver 50%; Tin	Silver
Still Plating or Barrel Plating	Still	Both	Both	Barrel	Both	Both
Major Plant Capacity Constraints	Space	Space	Old building	Space	Space	-
Pollution Equipment - Type	Hauling Service; No dumping	Now = Precipitation and Filtration; Future = Batch Process	Semi Continuous; Gas Chlorination. Only on Cyanide	None except for Cyanide conversion	Bath Destruction; Chemical	Destruction
Percent Effluent Treated	0%	40%+	100%	-	33%	100%
Water Usage - Gallons per Day	-	7,000	167,000	-	600	48,000
Dispose Into - Sewer or Stream	-	Sewer	Sewer	-	Both	Sewer
Sludge Removal - Method	Pick-Up Service	Negligible	Pick-Up and Sewer	-	Pick-Up	Pick-Up
Pollution Control Equipment - Installation Date	No Equipment	12 Months Ago	-	-	1969	February 1973
Operational Date	No Equipment	3 Months Ago	-	-	1969	Not Operating
Cost (Actual or Estimate)	$100,000-$150,000	$20,000-$50,000	$150,000-$200,000	$50,000	$7,000-$8,000	$9,000
Estimated Total Cost to Complete	-	$75,000	-	-	-	$9,000
Operating Cost of Pollution Control Equipment	-	$5,000-$10,000 per year	$400-$600 per month	-	$25 per week	-
Results Achieved	-	OK	Cyanide Only	-	Good Shape	Problems
Capitalization - Total	-	-	$400,000	-	$100,000	$100,000
Financing Capability	-	-	Good	-	Minor Problems	Minor Loans
Sales Per Year	$300,000-$400,000	$500,000	$786,000	-	$300,000	$200,000
Profit Before Taxes	-	10%	$22,000	-	Lost $ Last 3 Years	$20,000
Profit After Taxes	6-10%	-	$17,000	-	-	-

ENVIRONMENTAL PROTECTION AGENCY

ELECTROPLATING INDUSTRY

INDUSTRY SURVEY SUMMARY

EXHIBIT III-2
Page 1 of 6

Company Identification Number

1	2	3	4	5	6	7	8	9	10
Urban	Urban	Urban	Urban	Urban	Urban	Urban	Urban	Urban	Urban
Job Shop	Job Shop	Job Shop	Job Shop and Some Captive	Job Shop	Job Shop	Job Shop	Job Shop	Job Shop	Job Shop
Corporation	Corporation	Corporation	Corporation	Corporation	Corporation	Corporation	Corporation	Corporation	Corporation
18/40	7/-	33/25	13/-	13/20	9/30	13/-	20/30	20/-	30/-
17,000/ 8,000	10,000/ 6,000	35,000/ 30,000	18,000/ 8,000	7,000/ 6,000	8,500/ 10,000	18,000/ 17,000	8,000/ 5,500	10,000/ 8,000	3,300/ 500
25/18	10-12/8	30/15	35-40/8	7/4	8/6	37/29	55/33	30/22	25/19
5%	100%	5%	-	50%	-	-	-	-	-
95%	-	-	-	-	-	-	-	-	-
-	-	70%	-	-	-	75-80%	20%	-	95%
-	-	20%	-	Minor	-	-	5%	-	-
-	-	5%	-	-	-	-	25%	33%	-
-	-	Brass,Tin, Silver	-	Gold, Silver 50%; Tin	Silver	-	Tin-50%	Aluminum 33%	Tin 5%
Still	Both	Both	Barrel	Both	Both	Still	Both	-	Barrel
Space	Space	Old building	Space	Space	-	-	Space	Space	Space
Hauling Service; No dumping	Now = Precipitation and Filtration; Future = Batch Process	Semi Continuous; Gas Chlorination. Only on Cyanide	None except for Cyanide conversion	Bath Destruction; Chemical	Destruction	Neutralization and Destruction	Destruction Chlorination, Settling, Centrifuge	None	Integrated Cyanide
0%	40%+	100%	-	33%	100%	100%	10%	0%	100%
-	7,000	167,000	-	600	48,000	-	200,000	-	6,000
-	Sewer	Sewer	-	Both	Sewer	Sewer	Sewer	Sewer	Sewer
Pick-Up Service	Negligible	Pick-Up and Sewer	-	Pick-Up	Pick-Up	Pick-Up	Pick-Up	Pick-Up	Pick-Up
No Equipment	12 Months Ago	-	-	1969	February 1973	Began 13 Years Ago	1971	N/A	1953
No Equipment	3 Months Ago	-	-	1969	Not Operating	-	6 Months Ago	N/A	1953
$100,000- $150,000	$20,000- $50,000	$150,000- $200,000	$50,000	$7,000- $8,000	$9,000	-	$70,000	-	$50,000
-	$75,000	-	-	-	$9,000	-	$70,000	-	-
-	$5,000- $10,000 per year	$400-$600 per month	-	$25 per week	-	-	$700+ per month	-	-
-	OK	Cyanide Only	-	Good Shape	Problems	Good	Good-90% of the Time	Doing Nothing	Meeting Guidelines
-	-	$400,000	-	$100,000	$100,000	$250,000	$550,000	$100,000	-
-	-	Good	-	Minor Problems	Minor Loans	Available	Good	-	-
$300,000- $400,000	$500,000	$786,000	-	$300,000	$200,000	$800,000	$1,200,000	$500,000	$500,000- $700,000
-	10%	$22,000	-	Lost $ Last 3 Years	$20,000	-	-	-	-
6-10%	-	$17,000	-	-	-	-	3.8%	-	-

ELECTROPLATING INDUSTRY SURVEY SUMMARY (CONTINUED)

Data Item:	Company Identification Number						
	11	12	13	14	15	16	17
Urban or Rural Location	Urban	Urban	Urban	Urban	Urban	Urban	Rural
Job Shop or Captive Shop	Job Shop	Job Shop	Captive Shop	Job Shop	Job Shop	Job Shop	Job Shop
Corporation or Other	Corporation	Corporation	Corporation	Corporation	Corporation	Corporation	Corporati
Number of Years in Business - Company/Owner	12/-	13/13	-	-/44	20/-	27/8	36/-
Total Square Feet/Plating Square Feet	15,000/ 4,000	30,000/ 21,000	-/ 3,000	40,000/ 16,000	13,000/ 11,000	75,000/ 45,000	15,000/ 14,000
Total Employees/Plating Employees	28/20	70/50-60	-/5	69/45	18/15	43/34	25/23
Plating Lines (Percent of Sales)-							
Nickel	-	{20%	-	x	-	-	-
Chrome	99%		-	-	90%	20%	100%
Zinc	-	55%	-	-	-	-	-
Copper	-	x	-	-	-	-	-
Cadmium	-	-	-	-	-	9%	-
Other	-	Solder conversion coating	-	Anodizing, etc.	-	Anodizing and Painting	-
Still Plating or Barrel Plating	Both	Both	Barrel	Still	Still	Still	Still
Major Plant Capacity Constraints	Space	-	-	Space	-	-	-
Pollution Equipment - Type	Clearifier	Evaporate; Destruct; Ph control	Atmospheric Evaporators	None	None as such	Clearifiers; Rinses	Dillution
Percent Effluent Treated	100%	60%	Most	-	0	20%	100%
Water Usage - Gallons per Day	60	120,000	-	-	-	200,000	5,000
Dispose Into - Sewer or Stream	Sewer	Sewer	Sewer	Sewer	Sewer	Sewer	Stream
Sludge Removal - Method	Pick-Up	Pick-Up	No Sludge	Pick-Up	None	Pick-Up	Stream
Pollution Control Equipment - Installation Date	1961	12 Months Ago	2 Years Ago	None	N/A	-	1970
Operational Date	-	3 Months Ago	6-12 Months Ago	None	N/A	-	1971
Cost (Actual or Estimate)	-	$125,000	$3,000	$30,000-$40,000	$75,000	$50,000-$250,000	-
Estimated Total Cost to Complete	-	$205,000-$210,000	$3,000	-	$75,000	$50,000-$250,000	-
Operating Cost of Pollution Control Equipment	-	$5.10 per Hour	-	-	-	-	-
Results Achieved	Cyanide Only	Good	Good	Not Being Checked	Problem	Problem	Good
Capitalization - Total	$60,000	$620,000	-	$300,000	$83,000	$680,000	-
Financing Capability	-	Pretty Good	-	Good for $25,000-$100,000	Pretty Good for Small Plant	Bad	Available
Sales per Year	$60,000	$1,500,000	-	$1,250,000 $1,500,000	$275,000	$850,000	$600,000
Profit Before Taxes	-	$172,500	-	-	-	-	-
Profit After Taxes	-	$97,500	-	$20,000	5%	-$25,000	$20,000

EXHIBIT III-2
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ELECTROPLATING INDUSTRY SURVEY SUMMARY (CONTINUED)

Company Identification Number

12	13	14	15	16	17	18	19	20
Urban	Urban	Urban	Urban	Urban	Rural	Urban	Urban	Urban
Job Shop	Captive Shop	Job Shop	Job Shop	Job Shop	Job Shop	Job Shop	Job Shop	Job Shop
Corporation	Corporation	Corporation	Corporation	Corporation	Corporation	Corporation	Corporation	Corporation
13/13	-	-/44	20/-	27/8	36/-	40/-	30+/-	39/-
30,000/ 21,000	-/ 3,000	40,000/ 16,000	13,000/ 11,000	75,000/ 45,000	15,000/ 14,000	30,000/ -	36,000/ 28,000	60,000/ 30-35,000
70/50-60	-/5	69/45	18/15	43/34	25/23	50/40	59/40-45	120/100
{20%	-	x	-	-	-	45%	x) 50%	-
	-	-	90%	20%	100%	30%	x)	-
55%	-	-	-	-	-	-	-	-
x	-	-	-	-	-	-	-	-
-	-	-	-	9%	-	-	-	10%
Solder conversion coating	-	Anodizing, etc.	-	Anodizing and Painting	-	Gold and Silver	-	Precious Metal
Both	Barrel	Still	Still	Still	Still	Both	Both	Both
-	-	Space	-	-	-	-	-	Space
Evaporate; Destruct; Ph control	Atmospheric Evaporators	None	None as such	Cleari-fiers; Rinses	Dillution	Dillution	Electro-Chemical	Water Conser-vation; Ph Control
60%	Most	-	0	20%	100%	100%	100%	100%
120,000	-	-	-	200,000	5,000	-	-	133,000
Sewer	Sewer	Sewer	Sewer	Sewer	Stream	Sewer	Stream	Sewer
Pick-Up	No Sludge	Pick-Up	None	Pick-Up	Stream	None	None	Pick-Up
12 Months Ago	2 Years Ago	None	N/A	-	1970	June 1968	April 1, 1971	-
3 Months Ago	6-12 Months Ago	None	N/A	-	1971	January 1969	December 1973	-
$125,000	$3,000	$30,000- $40,000	$75,000	$50,000- $250,000	-	-	-	-
$205,000- $210,000	$3,000	-	$75,000	$50,000- $250,000	-	-	$400,000	$350,000- $375,000
$5.10 per Hour	-	-	-	-	-	-	-	-
Good	Good	Not Being Checked	Problem	Problem	Good	Minor Problems	Minor Problems	Problems
$620,000	-	$300,000	$83,000	$680,000	-	$700,000	-	$1,760,000
Pretty Good	-	Good for $25,000- $100,000	Pretty Good for Small Plant	Bad	Available	$150,000 Available	-	Near Capacity
$1,500,000	-	$1,250,000 $1,500,000	$275,000	$850,000	$600,000	$1,014,000	$1,000,000	$1,600,000 $1,975,000
$172,500	-	-	-	-	-	10%	-	-
$97,500	-	$20,000	5%	-$25,000	$20,000	-	-	-

ELECTROPLATING INDUSTRY SURVEY SUMMARY (CONTINUED)

Data Item:	Company Identification Number						
	21	22	23	24	25	26	
Urban or Rural Location	Urban	Urban	Urban	Urban	Urban	Urban	Urb
Job Shop or Captive Shop	Job Shop	Job Shop	Job Shop	Job Shop	Captive Shop	Job Shop	Job
Corporation or Other	Corporation	Corporation	Corporation	Corporation	Corporation	Corporation	Corp
Number of Years in Business - Company/Owner	62/-	40/-	40+/-	21/-	30/-	25/-	23/-
Total Square Feet/Plating Square Feet	140,000/ 50,000	60,000/ 35,000	100,000/ 90,000	21,000/ 17,500	-/ -	28,000/ 14,000	35,0 25,0
Total Employees/Plating Employees	425/375	125/60	140/125	28/23	-/150	75/50	70/35
Plating Lines (Percent of Sales)-							
Nickel	-	-	x) 50%	-	-	*	25%
Chrome	70%	70%	x)	-	-	*	-
Zinc	-	-	-	90%	10%	25%	-
Copper	-	-	-	-	5%	*	x) 25
Cadmium	-	-	-	-	5%	(* = 50%)	x)
Other	-	-	Rust Proofing	-	Brass 70%	Anodizing 25%	Prec Metal
Still Plating or Barrel Plating	Still	Both	Both	Both	Both	Both	Both
Major Plant Capacity Constraints	-	-	-	-	-	-	-
Pollution Equipment - Type	Conservation; Clearification	Ph Control	Chemical Destruction; Experimental	Cyanide to Cyanate Conversion	Cyanide Treatment	Cyanide to Cyanate Conversion	Clear
Percent Effluent Treated	100%	-	50%	50%	7%	50%	100%
Water Usage - Gallons per Day	-	200,000	-	-	3,000,000	340,000	4,000
Dispose Into - Sewer or Stream	Sewer	Sewer	Sewer	Sewer	Sewer	Sewer	Sewer
Sludge Removal - Method	-	None	Pick-Up	-	Pick-Up	None	Pick-
Pollution Control Equipment - Installation Date	-	-	April 1973	-	-	Cyanide- 3 years; Chrome- 6 months ago	-
Operational Date	-	-	2 Months ago	-	-	Chrome- August 1973	-
Cost (Actual or Estimate)	$50,000	$300,000	$75,000	$29,000	$80,000	$12,000	$30,0
Estimated Total Cost to Complete	-	$300,000	-	-	$120,000	-	-
Operating Cost of Pollution Control Equipment	-	-	-	-	$34,000 per Year	-	-
Results Achieved	Problems	Not Being Checked	Minor Problems	-	-	Good	Probl
Capitalization - Total	$2,000,000	-	$450,000	$61,000	-	$750,000	$240,0
Financing Capability	Good	Good	Good	Good	-	Pretty Good	Very
Sales per Year	$8,000,000	$2,000,000	$2,700,000	$373,600	-	$1,500,000	$1,250
Profit Before Taxes	-	-	-	$19,400	-	-	-
Profit After Taxes	-	Lost $	-	$13,500	-	-	-$20,0

ELECTROPLATING INDUSTRY SURVEY SUMMARY (CONTINUED)

Company Identification Number								
22	23	24	25	26	27	28	29	30
Urban	Urban	Urban	Urban	Urban	Urban	Urban	Rural	Urban
Job Shop	Job Shop	Job Shop	Captive Shop	Job Shop	Job Shop	Job Shop	Job Shop	Job Shop
Corporation	Corporation	Corporation	Corporation	Corporation	Corporation	Corporation	Partnership	Partnership
40/-	40+/-	21/-	30/-	25/-	23/-	15/13	10/9	58/38
60,000/ 35,000	100,000/ 90,000	21,000/ 17,500	-/ -	28,000/ 14,000	35,000/ 25,000	7,500/ 2,400	1,200/ 800	22,000/ 18,000
125/60	140/125	28/23	-/150	75/50	70/35	8/4	2/2	40/34
-	x) 50%	-	-	*	25%	x	x) 50%	20%
70%	x)	-	-	*	-	-	x)	20%
-	-	90%	10%	25%	-	-	-	15%
-	-	-	5%	*	x) 25%	x	x	15%
-	-	-	5%	(* = 50%)	x)	x	-	15%
-	Rust Proofing	-	Brass 70%	Anodizing 25%	Precious Metal 50%	Anodizing 40%	Brass, Bronze, Silver	Others 15%
Both	Both	Both	Both	Both	Both	Both	Both	Both
-	-	-	-	-	-	Space	Space	Space, Labor
Ph Control	Chemical Destruction; Experimental	Cyanide to Cyanate Conversion	Cyanide Treatment	Cyanide to Cyanate Conversion	Clearifiers	None	Cascade	Ph Control Rinse Tanks
-	50%	50%	7%	50%	100%	-	100%	100%
200,000	-	-	3,000,000	340,000	4,000	100,000	1,500	81,000
Sewer	Sewer	Sewer	Sewer	Sewer	Sewer	Sewer	Stream	Sewer
None	Pick-Up	-	Pick-Up	None	Pick-Up	-	City Dump	-
-	April 1973	-	-	Cyanide- 3 years; Chrome- 6 months ago	-	-	-	May 1972
-	2 Months ago	-	-	Chrome- August 1973	-	-	-	June 1973
$300,000	$75,000	$29,000	$80,000	$12,000	$30,000	$45,000- $85,000	-	$70,000
$300,000	-	-	$120,000	-	-	$45,000- $85,000	-	-
-	-	-	$34,000 per Year	-	-	-	-	$500 per Month
Not Being Checked	Minor Problems	-	-	Good	Problems	-	-	Good
-	$450,000	$61,000	-	$750,000	$240,000	-	-	$600,000
Good	Good	Good	-	Pretty Good	Very Tight	Bad Problem	-	Good
$2,000,000	$2,700,000	$373,600	-	$1,500,000	$1,250,000	$260,000	$30,000	$800,000
-	-	$19,400	-	-	-	-	-	-
Lost $	-	$13,500	-	-	-$20,000	$21,600	-	-

ELECTROPLATING INDUSTRY SURVEY SUMMARY (

Data Item:	Company Identificatio				
	(31)	(32)	(33)	(34)	(35)
Urban or Rural Location	Urban	Urban	Urban	Urban	Urban
Job Shop or Captive Shop	Job Shop	Job Shop	Job Shop	Job Shop	Job Shop
Corporation or Other	Corporation	Corporation	Corporation	Corporation	Corporation
Number of Years in Business - Company/Owner	26/26	1/9	7/-	11/-	31/31
Total Square Feet/Plating Square Feet	17,000/ 13,000	40,000/ 18,000	5,000/ -	4,900/ 3,000	15,000/ 7,500
Total Employees/Plating Employees	15/9	12/11	15/15	13/11	30/28
Plating Lines (Percent of Sales)-					
Nickel	-	x)	-	-	x)
Chrome	100%	x) 100%	-	-	x) Major
Zinc	-	-	25%	40%	x)
Copper	-	-	20%	2%	Minor
Cadmium	-	-	40%	40%	-
Other	-	-	Bronze-15%	Tin-12% Phosphating-6%	Gold
Still Plating or Barrel Plating	Still	Still	Both	Both	Still
Major Plant Capacity Constraints	Space	-	Space, Labor	Space	-
Pollution Equipment - Type	Now=None; Future= Finalizer with PH Control	Now=None; Future= Nickel Filter	Cyanide Conversion	Cyanide Conversion	Now=Automatic Foggers; Future=Reverse Osmosis and Evaporator
Percent Effluent Treated	0%	0%	10%	5%	0%
Water Usage-Gallons per Day	-	-	385,000	30,000	182,000
Dispose Into - Sewer or Stream	Sewer	Sewer	Sewer	Sewer	Sewer
Sludge Removal - Method	-	-	-	Pick-Up	No Sludge
Pollution Control Equipment-					
Installation Date	No Equipment	No Equipment	-	1971	-
Operational Date	No Equipment	No Equipment	-	-	-
Cost (Actual or Estimate)	$44,000-55,000	-	$40,000 60,000	$60,000 70,000	-
Estimated Total Cost to Complete	-	-	-	-	$295,000
Operating Cost of Pollution Control Equipment	-	-	-	-	-
Results Achieved	Meeting Guidelines	Problems	Meeting Guidelines	Meeting Guidelines	Good
Capitalization - Total	$320,000	$80,000	$95,000	$54,000	$336,000
Financing Capability	Good	Pretty Poor	Loans Available	Loans Available	Problems
Sales per Year	$400,000	-	$400,000	$218,000	$550,000
Profit Before Taxes	$32,000	-	$25,000	$3,000	-
Profit After Taxes	$24,000	-	$18,000	$2,400	$12,000

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INDUSTRY SURVEY SUMMARY (CONTINUED)

Company Identification Number

(34)	(35)	(36)	(37)	(38)	(39)	(40)	(41)
Urban	Urban	Urban	Urban	Urban	Urban	Urban	Urban
Job Shop	Job Shop	Job Shop	Job Shop	Job Shop	Job Shop	Job Shop	Job Shop
Corporation	Corporation	Corporation	Corporation	Corporation	Corporation	Corporation	Proprietorship
11/-	31/31	20/55	25/-	12/12	40/25	50+/43	15/40
4,900/ 3,000	15,000/ 7,500	10,000/ 9,000	7,000/ 4,000	8,000/ 6,500	30,000/ 18,000	15,000/ 7,000	10,000/ 9,500
13/11	30/28	11/9	34/25	15/10	60/50	31/28	18/17
-	x)	x	20%	55%	30%	15%	20%
-	x) Major	-	10%	13%	x	-	80%
40%	x)	50%	50%	-	30%	20%	-
2%	Minor	x	10%	15%	-	10%	x
40%	-	-	5%	-	30%	18%	-
Tin-12% Phosphating-6%	Gold	Black Oxide-30%	5%	17%	Black Oxide	Brass-20%: Phosphate Coating and Others-17%	-
Both	Still	Barrel	Both	Both	Both	Both	Both
Space	-	-	Space	Space	Space	Space	Space
Cyanide Conversion	Now=Automatic Foggers; Future=Reverse Osmosis and Evaporator	Now=Neutralization and Setting; Future=Water Conservation	Precipitation and Filtration; Cyanide Destruction	Drag-out Tank; PH Control	Dillution	Now=None Future=Settling	Cyanide Destruction; Conservation
5%	0%	100%	-	0%	-	-	100%
30,000	182,000	5,000	114,000	-	500,000	80,000	11,400
Sewer	Sewer	Sewer	Other	Sewer	Sewer	Sewer	Sewer
Pick-Up	No Sludge	Pick-Up	Pick-Up	Pick-Up	-	Pick-Up	Neligible
1971	-	1968	-	1969	-	No Equipment	1971
-	-	-	-	-	-	No Equipment	1972
$60,000 70,000	-	$40,000	$35,000	$35,000	$100,000	$50,000	$15,000
-	$295,000	$86,000+	$85,000	-	-	-	-
-	-	$16,000	-	-	-	-	-
Meeting Guidelines	Good	Problems	Good	Good-80% of Time	Meeting Guidelines	-	Meeting All Guidelines
$54,000	$336,000	$360,000	$75,000+	$165,000	$1,125,000	$521,000+	$400,000
Loans Available	Problems	Funds Available	-	Problems	No Problem	Loans Available	Loans Available
$218,000	$550,000	$180,000	-	$307,000	$1,500,000	$768,000	$250,000
$3,000	-	$12,600	-	$27,000	$225,000	$150,250	$45,000
$2,400	$12,000	$9,000	-	-	$75,000	$100,100	$20,000+

ENVIRONMENTAL PROTECTION AGENCY

ELECTROPLATING INDUSTRY

INDUSTRY SURVEY SUMMARY

Data Item:	Company Identification Numbe					
	42	43	44	45	46	47
Urban or Rural Location	Rural	Urban	Urban	Urban	Urban	Urban
Job Shop or Captive Shop	Job Shop	Job/Captive	Job Shop	Job Shop	Job Shop	Job Shop
Corporation or Other	Corporation	Corporation	Corporation	Corporation	Corporation	Corporation
Number of Years in Business - Company/Owner	20/-	10/-	40/-	18/-	26/26	20/-
Total Square Feet/Plating Square Feet	13,000/ 9,500	30,000/ -	50,000/ 38,000	5,300/ 5,000	11,000/ 6,000	4,000/ 4,000
Total Employees/Plating Employees	16/13	63/45	109/71	8/7	20/12	4/4
Plating Lines (Percent of Sales)-						
Nickel	-	{ 100%	40%	-	{ 95%	-
Chrome	98%		20%	80%		100%
Zinc	-	-	10%	10%	-	-
Copper	-	-	-	-	5%	-
Cadmium	2%	-	-	10%	-	-
Other	-	-	-	-	-	-
Still Plating or Barrel Plating	Still	Still	Still	Still	-	Still
Major Plant Capacity Constraints	Space	Space	Space	Labor	-	Space
Pollution Equipment - Type	None	PH Control Chromium Conversion Clarification Cyanide Destruction	-	None	PH Control	None
Percent Effluent Treated	-	100%	-	-	100%	-
Water Usage - Gallons per Day	7,500	200,000	117,000	16,000	17,000	-
Dispose Into - Sewer or Stream	Stream	Sewer	-	Sewer	Sewer	Sewer
Sludge Removal - Method	-	Clar	-	Drums	-	-
Pollution Control Equipment - Installation Date	-	-	-	-	-	-
Operational Date	-	-	-	-	-	-
Cost (Actual or Estimate)	-	-	$3,000,000	$25,000 E.	-	-
Estimated Total Cost to Complete	-	-	-	-	-	-
Operating Cost of Pollution Control Equipment	-	-	-	-	-	-
Results Achieved	-	-	-	-	-	-
Capitalization - Total	$120,000	$511,000	-	$80,000	$27,000	-
Financing Capability	Poor	-	-	-	-	$20,000
Sales per Year	$250,000	$1,800,000	$1,875,000	$150,000	$350,000	$200,000
Profit Before Taxes	-	$187,200	.17%	-	-	$40,000
Profit After Taxes	$8,250	$102,600	$3,188	$1,500	-	-

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ENVIRONMENTAL PROTECTION AGENCY

ELECTROPLATING INDUSTRY

INDUSTRY SURVEY SUMMARY

Company Identification Number

43	44	45	46	47	48	49	50	51
n	Urban	Urban	Urban	Urban	Urban	Urban	Urban	Urban
/Captive	Job Shop	Job Shop	Job Shop	Job Shop	Job Shop	Job Shop	Job Shop	Job Shop
oration	Corporation	Corporation	Corporation	Corporation	Corporation	Single Proprietorship	Partnership	Corporation
-	40/-	18/-	26/26	20/-	-	66/13	20/4	-
00/	50,000/ 38,000	5,300/ 5,000	11,000/ 6,000	4,000/ 4,000	-	5,000/ 2,000	2,500 -	7,500/ 2,300
5	109/71	8/7	20/12	4/4	6/5	20/10	7/5	13/9
	40%	-	95%	-	-		-	X
	20%	80%		100%	90%	80%	-	-
	10%	10%	-	-	-	-	10%	-
	-	-	5%	-	-	X	X	-
	-	10%	-	-	10%	1%	30%	X
	-	-	-	-	-	20%	60%	X
l1	Still	Still	-	Still	Still	Still	Still	Still
e	Space	Labor	-	Space	Space	Space	Space	Labor-Space
Control omium ersion ifica- Cya- De- ction	-	None	PH Control	None	None	PH Control Counter Flow Rinsing	None	None
	-	-	100%	-	-	-	-	-
,000	117,000	16,000	17,000	-	-	15,000	-	10,000
r	-	Sewer	Sewer	Sewer	Sewer	Sewer	Sewer	Sewer
	-	Drums	-	-	-	-	-	-
	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-
	$3,000,000	$25,000 E.	-	-	-	$25,000 E	-	$15,000 E
	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-
,000	-	$80,000	$27,000	-	-	$40,000	$100,000	$61,000
	-	-	-	$20,000	-	-	-	-
00,000	$1,875,000	$150,000	$350,000	$200,000	$200,000	$200,000	$100,000	$250,000
,200	.17%	-	-	$40,000	$50,000	$30,000	-	$15,000
,600	$3,188	$1,500	-	-	-	-	-	-

ENVIRONMENTAL PROTECTION AGENCY

ELECTROPLATING INDUSTRY

INDUSTRY SURVEY SUMMARY

Data Item:	Company Identification Number 52	53	54	55	56	57
Urban or Rural Location	Urban	Urban	Urban	Urban	Urban	Urban
Job Shop or Captive Shop	Job Shop	Job Shop	Job Shop	Job Shop	Job Shop	Job Shop
Corporation or Other	Corporation	Corporation	Corporation	Corporation	Corporation	Partnership
Number of Years in Business - Company/Owner	32/ 6	18/ 18	25/ 23	- -	47/ 6	20/ 30
Total Square Feet/Plating Square Feet	8,400/ 3,000	6,000/ 5,800	9,300/ 6,900	25,000/ -	24,000/ 23,000	4,500/ 3,000
Total Employees/Plating Employees	6/4	12/9	20/17	45/37	40/33	9/7
Plating Lines (Percent of Sales)-						
Nickel	-	-	-	-	-	{ 25%
Chrome	-	X	-	60%	-	
Zinc	-	25%	X	-	55%	
Copper	-	10%	-	40%	-	-
Cadmium	-	60%	X	-	18%	-
Other	X	5%	X	- *	27%	75%
Still Plating or Barrel Plating	-	Still	Barrel	Barrel/ Still	Barrel	Still
Major Plant Capacity Constraints	-	Space	-	Location	-	Location/ Space
Pollution Equipment - Type	None	Cyanide Destruction	Cyanide Destruction	PH Control Cyanide Destruction		None
Percent Effluent Treated	-	-	-	-	-	None
Water Usage - Gallons per Day	1,500	33,000	65,000	90,000	192,000	2,600
Dispose Into - Sewer or Stream	Sewer	Sewer	Sewer	Sewer	Sewer	Sewer
Sludge Removal - Method	-	-	-	-	-	-
Pollution Control Equipment - Installation Date	-	-	-	-	-	-
Operational Date	-	-	-	-	-	-
Cost (Actual or Estimate)	-	-	-	-	-	-
Estimated Total Cost to Complete	-	-	-	-	-	-
Operating Cost of Pollution Control Equipment	-	-	-	-	-	-
Results Achieved	-	-	-	-	-	-
Capitalization - Total	-	$75,000	$71,000	$180,000	$308,000	$50,000
Financing Capability	-	-	-	-	-	-
Sales Per Year	$75,000	$25,000	$375,000	$1,100,000	$1,300,000	$113,000
Profit Before Taxes	-	$16,000	$18,000	$22,000	$140,000	-
Profit After Taxes	-	-	-	-	-	$(11,000)

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ENVIRONMENTAL PROTECTION AGENCY

ELECTROPLATING INDUSTRY

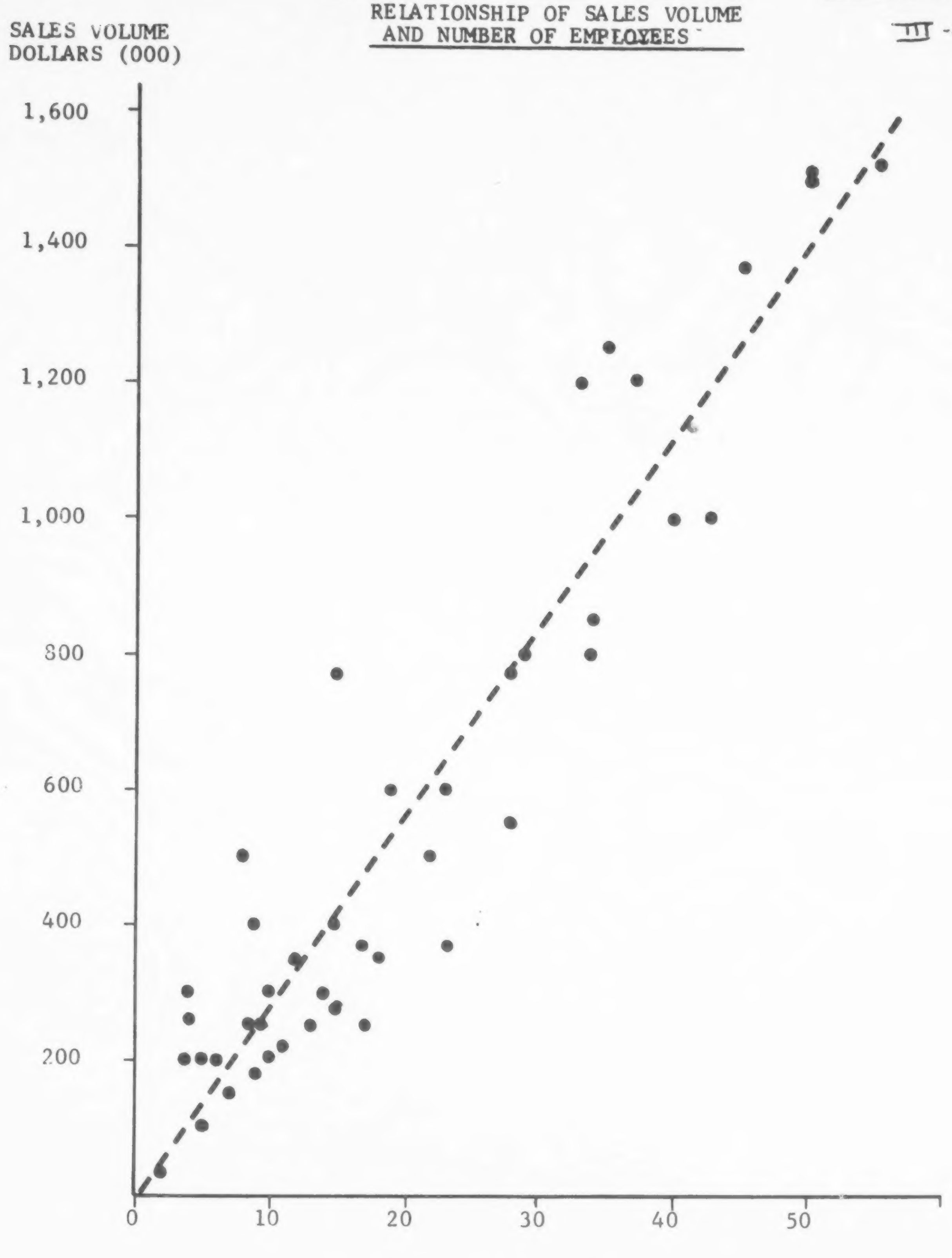
INDUSTRY SURVEY SUMMARY

Company Identification Number						
53	54	55	56	57	58	59
rban	Urban	Urban	Urban	Urban	Urban	Urban
ob Shop	Job Shop	Job Shop	Job Shop	Job Shop	Job Shop	Job Shop
rporation	Corporation	Corporation	Corporation	Partnership	Corporation	Corporation
/ 	25/ 23	- -	47/ 6	20/ 30	- -	- -
000/ 800	9,300/ 6,900	25,000/ -	24,000/ 23,000	4,500/ 3,000	- -	8,000/ -
/9	20/17	45/27	40/33	9/7	20/21	15/14
	-	-	-	25%	-	-
	-	60%	-		-	-
%	X	-	55%		-	-
0%	-	40%	-	-	X	-
%	X	-	18%	-	-	-
	X	-	27%	75%	X	X
		*				
ill	Barrel	Barrel/ Still	Barrel	Still	-	Both
ace	-	Location	-	Location/ Space	-	-
anide struc- on	Cyanide Destruction	PH Control Cyanide Destruction		None	None	None
	-	-	-	None	None	
,000	65,000	90,000	192,000	2,600	15,000	-
wer	Sewer	Sewer	Sewer	Sewer	Sewer	Sewer
	-	-	-	-	-	-
	-	-	-	-	-	-
	-	-	-	-	-	-
	-	-	-	-	-	-
	-	-	-	-	-	-
	-	-	-	-	-	-
	-	-	-	-	-	-
5,000	$71,000	$180,000	$308,000	$50,000	-	$81,000
	-	-	-	-	-	-
5,000	$375,000	$1,100,000	$1,300,000	$113,000	$600,000	$300,000
6,000	$18,000	$22,000	$140,000	-	$66,000	$ 12,000
	-	-	-	$(11,000)	-	-

EXHIBIT III-3

III -37

RELATIONSHIP OF SALES VOLUME AND NUMBER OF EMPLOYEES



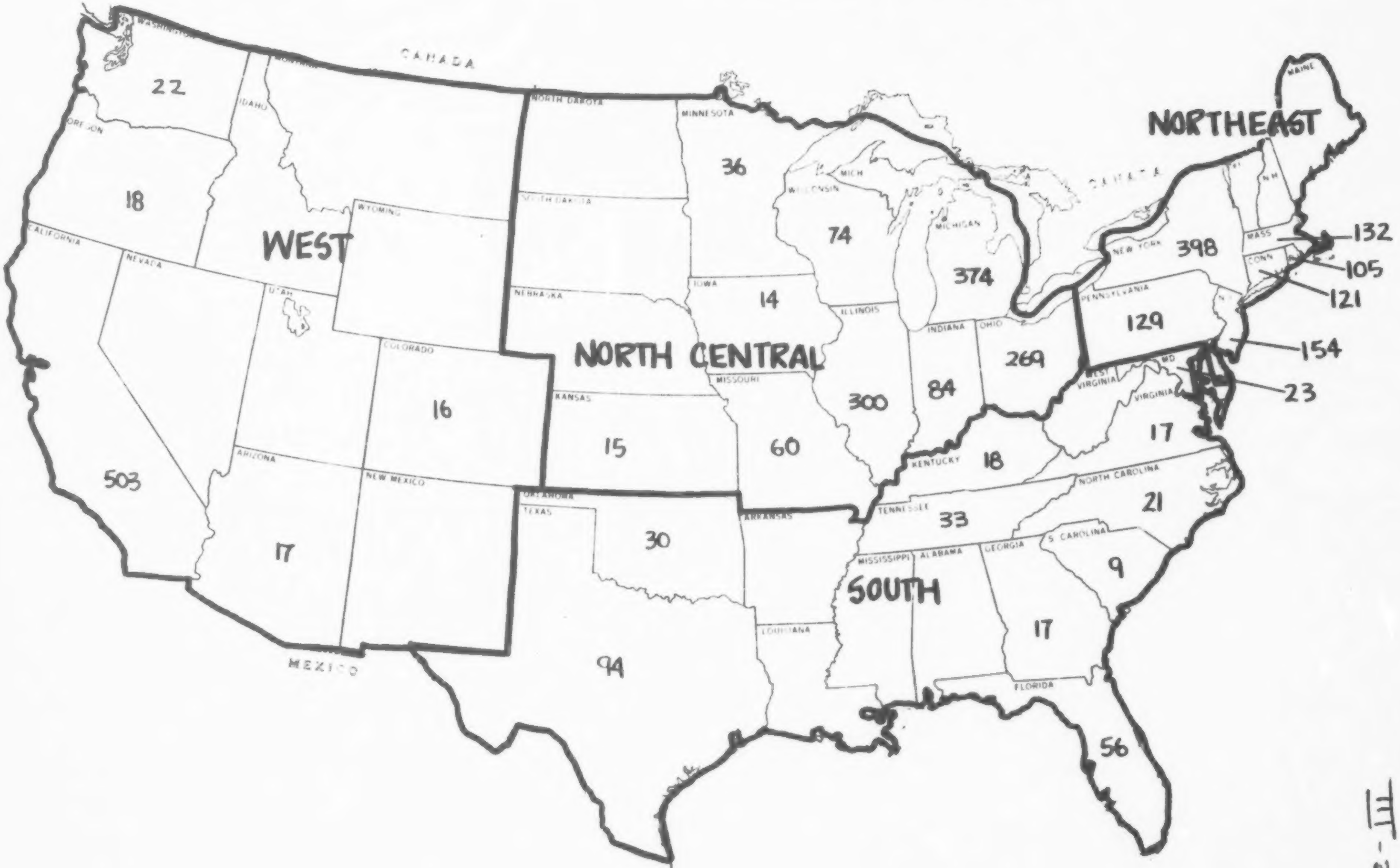
Source: NAMF Surveys and Kearney Survey

EXHIBIT III-4

ENVIRONMENTAL PROTECTION AGENCY

ECONOMIC ANALYSIS OF THE PROPOSED EFFLUENT GUIDELINES FOR THE ELECTROPLATING INDUSTRY

LOCATION OF INDEPENDENT ELECTROPLATERS


CANADA
MEXICO
WEST
NORTH CENTRAL
SOUTH
NORTHEAST
WASHINGTON 22
OREGON 18
CALIFORNIA 503
IDAHO
NEVADA
UTAH
WYOMING
ARIZONA 17
COLORADO 16
NEW MEXICO
NORTH DAKOTA
SOUTH DAKOTA
NEBRASKA
KANSAS 15
MINNESOTA 36
IOWA 14
MISSOURI 60
WISCONSIN 74
ILLINOIS 300
MICH
MICHIGAN 374
INDIANA 84
OHIO 269
OKLAHOMA 30
TEXAS 94
ARKANSAS
LOUISIANA
MISSISSIPPI
ALABAMA
TENNESSEE 33
KENTUCKY 18
GEORGIA 17
FLORIDA 56
S. CAROLINA 9
NORTH CAROLINA 21
VIRGINIA 17
WEST VIRGINIA
MD
NEW YORK 398
PENNSYLVANIA 129
MAINE
N.H.
VT
MASS
CONN
132
105
121
154
23

IV - FINANCIAL PROFILE

Only a limited amount of information is available within the Electroplating Industry relative to the financial condition of individual firms. The major reason for this is that the majority of the firms are relatively small, family controlled businesses, and the financial conditions of these firms are considered to be confidential in nature. Industry studies, which have been made available, have been supplemented with direct contacts with individual firms. This was done to cross-check the industry data and to develop a general profile of firms of varying sizes of employment and sales.

GENERAL INDUSTRY FINANCIAL STATISTICS

Exhibit IV-1, Page 1, contains general financial statistics for SIC 3471 which includes electroplating.

Exhibit IV-1, Page 2, contains some of the same statistics as page 1 but presents a distribution of the data by the average number of employees per establishment.

These two exhibits can be analyzed to show the general trend of the Plating and Polishing Industry. However, it is not possible to isolate the copper, nickel, chromium, and zinc electroplating plants from these numbers. Careful analysis of these data in conjunction with the other data does allow general conclusions to be made. Specific comments appear later in this section of the report.

OPERATING REVENUES

The 1967 Census of Manufactures provided data which indicated that the average value of shipments for electroplating shops was approximately $14,500 per employee. In 1972 this figure was approximately $20,000 per employee. The small shops employing less than five people had an average annual sales ranging from $14,500 to $58,000, or an average of $29,000 for a two man shop in 1967, and $40,000 for a two man shop in 1972. The large shops ranging between 250 and 500 employees had average annual sales of approximately $6 million per establishment in 1967, and approximately $8 million in 1972. These data have been summarized in Exhibit IV-2.

In Kearney's survey, which covered 60 electroplating shops ranging from 2 to 425 employees, sales ranged from $25,000 per year in the smallest shop to $8 million per year in the largest shop. By adjusting the 1967 Census data for five years at an annual increase of 6.9%, a good correlation is found between the survey data and the 1967 adjusted Census data. This information is summarized in Table IV-1.

Table IV-1

Estimated Annual Sales Per Establishment-1972 ($000)

Employee Range	Adjusted 1967 Data	Survey Sample Data
1 - 4	$ 40.3	$ 30.0
5 - 9	135.0	210.0
10 - 19	262.9	317.0
20 - 49	594.3	610.0
50 - 99	1,345.5	1,500.0
Over 100	3,613.0	$3,275.0

Source: A. T. Kearney Survey Data
Census of Manufactures, 1967

INDUSTRY PROFITABILITY

Because of the dissimilar nature of electroplating shops, it is practically impossible to generalize about the industry. However, several studies have been conducted which provide a broad view of profit ranges and trends for the industry.

(a) Robert Morris Annual Study

Exhibit IV-3 presents balance sheet, income statement, and operating ratio data for SIC 3471 as reported in annual surveys by Robert Morris Associates. Although it is not possible to isolate the electroplating industry portion of these data, they can be used as a guide for establishing ranges of industry financial data.

Table IV-2 summarizes the before tax profit data from Exhibit IV-3.

Table IV-2

1971 Profits of Metal Finishing Industry (Profits before Taxes as Percent of Sales)

	Asset Size			
Year	Under $250M	$250M to 1,000M	$1,000M to 10,000M	All Sizes
1972	3.8	4.0	5.0	4.4
1971	2.9	2.3	2.5	2.7
1970	.6	4.1	4.5	4.0
1969	4.4	2.3	5.4	4.9

Source: Exhibit IV-3 (Robert Morris Annual Surveys)

Note the following:

1. The average 1972 profits for all size shops have almost recovered to 1969 levels after having declined for two consecutive years in 1970 and 1971.

2. There are no steady trends in either direction for any one group.

3. Profits in 1971 were generally low for the industry, although they were significantly better than 1970 for the very small plant group.

(b) National Association of Metal Finishers in 1970 Cost Survey

The 1970 operating cost survey conducted by the National Association of Finishers (NAMF) indicated an average pretax profit of 4½% for the firms surveyed. The details of this study are shown in Exhibit IV-4. It appears that the very small and the very large firms are less profitable than those firms with sales in the mid-ranges. The exception appears to be hard chrome platers where the very small shops are the least profitable, and the larger shops are the most profitable.

According to the data collected and the concensus of shop owners and other industry sources some increase in profitability has occurred since the NAMF study. The increase was believed due to the general upswing in the economy, during which time plants were operated close to full capacity. We understand these volume variations are fairly common in the plating industry and account for some fairly wide swings in the profits of many small companies. It is noteworthy that no specific pattern was established with regard to profitability according to the type of metal finishing done or by specialization. Many small shops attempt to maintain diverse product lines to satisfy customer requirements. Unless some operations are less profitable than others, firms could be worse off by following this practice.

Technical requirements for some processes, such as decorative chrome plating, require multiple plating operations. Diversification, therefore, is a by-product of these shops. These shops may be faced with the necessity of having to treat multiple wastes because of differences in wastes generated by each process. However, data in the effluent guidelines study did not indicate that any additional costs would result from this.

(c) Supplemental Profit Survey

Additional profit data were gathered by A. T. Kearney to substantiate assumptions made by industry resources and to up-date the 1970 NAMF study. 1972 profits as reported by 16 shops were higher than 1970-1971. Nine shop owners stated they had 5% - 10% before tax profits on sales. Seven other owners reported a range of profits between 0 and 10-20%. These profit data are shown in Exhibit IV-5.

Profits of electroplating shops with 20 employees or less were reviewed in particular, since this group is expected to have low cash flow because of low volume of sales and also limited borrowing capacity. The 1970 profit data indicated a 9% profit before taxes was earned by some shops with fewer than five employees. The results of profit studies for six shops interviewed in the field survey is shown in Table IV-3.

Table IV-3

Summary of Profits - Electroplating Industry (Plants Less Than 20 Employees)

Plant Size Employees	Number of Plants	Average of Profitability as Percent of Sales (Before Taxes)
1 - 5	3	12.3%
5 - 20	3	7.8
Group Average		10.2%

Source: A. T. Kearney, Inc. Field Survey

These survey date indicate that the small shops surveyed were more profitable as a percent of sales than the large shops. This is consistent with original data in NAMF.
Several industry sources visited during field surveys indicated a profit objective of 10 percent was typically sought by plating shops.

(d) Profit Fluctuations in Small Shops

The small plating shops are subject to great fluctuations in profitability, partly due to their versatility in adapting to changes in types of markets which are available, and their ability to absorb increased volume without major changes in overhead and fixed costs.

However, there appears to be some lag in ability of a small shop owner to be able to eliminate losses due to cost changes. Because the small shops compete actively, increases in labor or material costs are not always passed immediately to they buyers of plating services. This is especially true in metropolitan areas. Since labor is not completely organized in the industry, wages may not all rise simultaneously, and a shop experiencing rising wages may not choose to increase prices for fear of some loss of customers.

Small shop owners are also fairly unsophisticated with respect to modern cost accounting methods. For example, in a small plant where direct costs are based on labor and materials, with labor being the significant variable, if the level of production changes significantly, overhead may not be absorbed completely and profits may suffer until a change in accounting practice is completed. Production record keeping is relatively uncommon and the emphasis in the shop is usually on providing fast turnaround for the customer rather than maintaining a standard output per unit of labor throughout the plant. After the financial results of operation are reported, shop owners may realize that profit problems exist. Only then are price changes or other steps taken to improve earnings.

An example of the profit variation which occurred in one plant is shown on Table IV-4.

Table IV-4

Plant 6-53
Three Year Profit Study

Year	Sales	Percent Profit
1971	$205,000	(3%)
1972	255,000	(4%)
1973	250,000	6%

Source: A.T. Kearney, Inc. Industry Survey

The owner attributed the shift from losses in 1971 of approximately $15,000 to a profit of $16,000 in 1973 to price increases of 10-15% during the two years, and some increase in volume of work in the plant.

Profits in small closed corporations can also be affected by benefits and other compensations paid to officers of the corporations. These data were not made available, therefore, it is practically impossible to accurately determine what, if any, differences in profits are attributable to differences in compensation. In this regard, profitability may not necessarily be an accurate method of comparing small, privately owned and operated firms.

(e) External Factors Affecting Profits

The Electroplating Industry is highly dependent on other primary industries such as electronics, automotive, housewares, and metal working. Although the quality of the plating and the ability of the shop to meet customer delivery requirements and specifications are important considerations, the demand for electroplating is not always a function of industry promotion or sales efforts.

A major problem affecting profitability in the industry is its dependency upon the general economy. In recent years as the economy has had an upswing, many shops began operating at near full capacity.

An important consideration in assessing the economic impact of pollution abatement is the extent to which shops remaining in the industry will be able to absorb high demands created by shops leaving the industry.

Industry sources indicated that closures could affect capacity. Shops remaining in the industry could absorb some of the plating work by extending their working hours. This alternative could, in fact, also increase profitability, as greater absorption of fixed costs occurs with increased utilization. Industry sources further indicated that a labor shortage exists, particularly within the metropolitan areas where a large majority of the shops are located. The work involved in electroplating shops is not conducive to attracting large numbers of workers. Consequently, rather than operating two shifts, many shops extend the working time on one shift to nine or ten hours per day, and operate on a six-days per week basis.

In addition to labor constraints, shops located within metropolitan areas generally have limited space for expansion. Therefore, these shops are restricted and usually cannot expand in their existing location. This element was emphasized in interviews with shop owners. Although working hours may be extended, this can create storage problems. If products are bulky and shipments cannot be made immediately or during the off-hours, a shop may not be able to extend working hours because of unavailability of space.

SUMMARY OF INDUSTRY PROFITS

Industry profits in 1973 were estimated to be 5.9% of sales overall. This is based on the adjusted profits reported in the NAMF 1970 study. Adjustments were made based on interviews and analysis of various sizes of plants in the industry.

VALUE OF ASSETS

The Electroplating Industry is characterized by relatively low capital investment, usually represented by plating tanks, material handling equipment, rectifiers or generators, plating solutions, and buildings.

A study published by the University of Michigan in 1967 on the Metal Finishing Industry presented the following capital investment data:

Table IV-5

Type of Operation	Average Capital Investment Per Firm	
	N.A.M.F. Members	Total Industry
Chrome Platers	$224,700	$47,700
General Platers	300,010	63,100

Source: University of Michigan Study

The spread between NAMF members and total industry is caused by the fact that the NAMF membership is almost entirely composed of large establishments.

Once purchased and installed, the market value of the equipment used in electroplating decreases rapidly. Industry sources interviewed agreed that the market value of used equipment is worth about 15-20% of the purchase price after only two years of operation. Corrosive materials used in electroplating contribute to the rapid deterioration of tanks and other equipment.

Little can be said about the capitalization of firms in the industry. For example, a highly mechanized firm can have a capital to sales ratio of over 80 percent while a manual shop could have a ratio as low as 10-25 percent. In the Kearney survey, the overall average for 20 firms which provided data was 44 percent. This compares to the University of Michigan study where the average ratio approximated 83 percent for NAMF firms and 75 percent for all firms in the industry. The variations may be due to the level of automation in the plants which were visited. Obviously, analysis of the two studies would require isolating such factors before conclusions can be drawn. The University of Michigan data do not indicate the level of automation. It is also believed that variations in costs of buildings and land which are included in some of the data are contributing factors.

COST STRUCTURE

Information on the cost structure of the Electroplating Industry is included in the "Price Effects" section of this report.

FINANCING ADDITIONAL CAPITAL REQUIREMENT

In general, smaller companies in the Electroplating Industry have experienced difficulty in obtaining financing for both productive and nonproductive assets. Owners often have to pledge assets of value equal to or greater than the amount of the loan. Since most companies are small with low capital investment, the asset security requirement can be a serious problem if pollution control equipment costs approach the cost of existing unpledged assets.

Exhibit IV-6 summarizes interviews with banks on the question of financing capital requirements. While all the banks did not have specific experience with the Electroplating Industry, this was not deemed a criteria for obtaining financing. The important consideration is the ability to service the debt and the personal reputation of the business owners.

Interviews with industry sources and governmental agencies provided additional insight into factors which are taken into consideration if financing is required for capital equipment. The following paragraphs summarize the data obtained in these interviews:

1. Private Funds represent resources of individual owners involved in the daily operations of their companies, resources of nonoperating family owners, and investors entrusting the operations to a manager or management groups.

(a) One group of shop operators is represented by aged owners having been in business for long periods of time. Strong concern was expressed about devoting life savings, set aside for retirement, to pollution control. Unless the payback period is reasonably short, funds would not be available from this source.

(b) A second group consisting of nonoperating family members indicated that funds can be provided by expanding the borrowing capacity of the plant through direct loans or by reinvesting dividends. This group is more concerned with the diminishing return on investments and questioned whether the costs of pollution control exceed the long-term benefits. Consequently, their decisions are based on seeking other more profitable investments rather than preserving a company for the purpose of providing an income for the operating principal.

(c) Although absentee owners were not interviewed, one plant manager responsible for an operation believed funds could be obtained for pollution control providing that price increases would be sufficient to pay for increased costs and profitability would not be reduced.

2. Bank Loans represent the most desirable method of financing, according to the field study reports. Most of the shop owners indicated that loans will be required to meet the cost of controlling pollution. Banks, on the other hand, indicated that specific conditions will be required before companies could qualify for sizable loans.

(a) Little concern was expressed by banks in general as to the nature of equipment being purchased. Most banks indicated that equipment loan decisions are usually based on adequacy of cash flow to meet debt retirement.

(b) No significant variations were found in the criteria set by banks in any of the cities where interviews were conducted.

(c) None of the banks had prior experience with pollution control financing.

(d) Most of the banks believed that some government assistance would be available for the plating companies. All indicated SBA could be a possible source.

(e) The size of the loan requirements did not appear to present a problem provided the companies could support the debt. All banks, including branch bank operations in New York and California indicated they would have no problems meeting requirements in the $25,000 to $50,000 ranges.

(f) A maximum amortization period of 5 years would apply to small firms while larger firms might obtain a longer term due to their larger amount of collateral and cash flow.

3. SBA Guaranteed Loan program is a possible source of financing for most of the companies studied, although a few establishment owners who were interviewed were not in favor of utilizing this source.

(a) Industry sources indicated that time delays in consummating the loan ranged from two weeks to a year. SBA and bank contacts indicated 30 days as being typical.

(b) Banks agreed with industry contacts that SBA guaranteed loans are "last resort" efforts, entered into only if conventional bank loans are not available.

4. Public Financing. Most of the companies in the industry are either closely held corporations or partnerships. There are few public corporations. For this reason, normal methods of outside financing is by bank loan. Very little, if any, financing is accomplished by issuance of stock.

5. Governmental Assistance. Under its Disaster Loan Program, SBA presently finances on a direct basis certain projects. An example is where assistance is provided under the Federal Coal Mine Health and Safety Act of 1969, where loans are made to mines to correct deficiencies which have been identified by the Bureau of Mines. A more recent program involves companies required to meet OSHA standards. If it is determined that a firm is likely to suffer substantial economic injury without

the loan, SBA resources may be available. Under this program, loan applicants may be considered under either of the following:

(a) Voluntary Compliance Procedure. When a small business concern independently makes changes in order to comply with Federal Standards.

(b) Cited Violation Procedure. When a small business concern is required by the OSHA administration to undertake action in order to meet Federal and State standards.

SBA contacts indicated that similar programs could probably be initiated for small concerns required to meet water pollution standards once the standards are promulgated and enforced, assuming that funds are available. However, there is no present program in existence.

6. Industrial Revenue Bonds have been used in recent years to finance pollution abatement equipment. The value of bonds issued has increased from $85 million in 1971 to an estimated $1 billion in 1972. These bonds generally carry a rate of 6 percent. Due to the high cost of issuing these bonds, the minimum value of an issue is usually in excess of one-half million dollars. Presently, only the very largest of the electroplating shops would be able to avail themselves of this type of financing. This type of financing presently will not be of assistance to the small shops for financing pollution abatement equipment.

BORROWING CAPACITY OF FIRMS

(a) Robert Morris Statement Studies

The debt to equity ratios for 100 metal finishing shops, from the Robert Morris Annual Statement Study in 1972, given in Exhibit IV-3, are summarized in Table IV-6.

Table IV-6

Debt to Equity Ratios of Electroplating Firms

Asset Size	Average Sales	Average Debt/Equity
Under $250 thousand	$ 378,000	1.6
$250,000 to $1 million	963,500	1.0
$1 million to $10 million	4,253,000	.9

Source: Exhibit IV-3

This study indicates that the small firms have heavier debt in proportion to their asset size than the large firms. This could be attributable to a number of factors, including the following:

1. Low original capitalization of the companies may have required owners to provide additional funds through debt rather than by additional capital contributions.

2. Cash flows may not have been adequate enought to retire debts.

3. Loan agreements with banks prevent retirement of subordinated debts such as loans to owners.

4. Owners have taken salaries or dividends out in the form of long term debt during poor profit years.

(b) Kearney's Field Study Observations

Exhibit IV-5 shows sales, long term debt, and equity positions of 14 companies which provided sufficient financial data in the Kearney Survey. These companies represented both large and small companies as indicated by the sales volumes and employment.

Eight of the companies covered in Exhibit IV-5 had long term debts ranging from $21,000 to over $800,000. Debts were payable in from three to ten years. Some of these loans represented mortgages on real property, however the majority were for equipment purchases. Two of the loans were SBA guaranteed while others were conventional bank loans secured by real estate, chattel mortgages on equipment, and personel guarantees of the principals.

Table IV-7 summarizes the long term debt to equity ratios for four companies listed in Exhibit IV-5.

Table IV-7

Long Term Debt to Equity

Kearney Survey

Sales	Long Term Debt	Equity	D/E
$ 342,000	$125,000	47,000	4.6
450,000	21,000	71,000	.3
1,200,000	30,000	160,000	.2
1,800,000	142,000	511,000	.3

Source: Exhibit IV-5

The debt to equity ratios in this study are generally lower than shown in the Robert Morris Study; however, since balance sheets were not made available by the companies studied in the field, it is not possible to reconcile the differences between the ratios.

COST AND TERMS OF LOANS

Banks, industry sources, and SBA loan officers have quoted a variety of interest rates and terms which they estimate will be available to electroplating plants.

1. Cost of Loans. All of the banks contacted were quoting loans at about 3 percent over prime. Because prime rates have been quite volatile in recent periods, it is difficult to accurately predict the cost of pollution equipment loans.

2. Terms of Loans. Exhibit IV-5 shows that the amortization of long term loans ranged from three to ten years. Several banks stated that a five year period is more typical, but in unusual cases the period could be extended for up to ten years. Longer time periods are available if real estate is used as collateral.

SBA expects the period could be ten or more years; however, since the banks generally set the time frame, it may be difficult to expect extended loan periods unless they are direct loans from SBA, and direct loans are rare.

EXHIBIT IV-1
Page 1 of 2

ENVIRONMENTAL PROTECTION AGENCY

ELECTROPLATING INDUSTRY

GENERAL INDUSTRY FINANCIAL STATISTICS

SIC: 3471 PLATING & POLISHING

NUMBER OF ESTABLISHMENTS(1970): 3,241 BOOK VALUE OF ASSETS PER EMPLOYEE (1968): $5,937
SPECIALIZATION RATIO (1967): NA& COVERAGE RATIO (1967): NA& CONCENTRATION RATIO (1967): 4 LARGE 5% 8 LARGE 9%

	ALL EMPLOYEES		PRODUCTION WORKERS							
YEAR	NUMBER (000)	PAYROLL ($MIL.)	NUMBER (000)	MAN-HOURS (MIL.)	WAGES ($MIL.)	VALUE ADDED ($MIL.)	COST OF MATERIALS ($MIL.)	VALUE OF SHIPMENTS ($MIL.)	CAPITAL EXPENDITURES ($MIL.)	END-OF-YEAR INVENTORIES ($MIL.)
1958	38.5	196.3	33.5	59.1	117.7	253.5	106.1	359.1	15.9	23.5
1959	43.3	189.5	37.2	72.0	142.3	325.8	127.3	451.3	15.2	21.3
1960	44.7	200.0	38.1	72.6	161.5	337.0	128.3	465.1	19.1	20.5
1961	43.9	200.5	37.1	71.8	151.3	330.9	124.3	456.7	16.2*	20.4
1962	49.2	211.5	41.4	89.4	182.0	401.2	147.9	549.1	25.5	20.9
1963	45.0	223.5	37.7	74.8	165.6	373.2	148.3	517.6	20.0	22.1
1964	45.4	239.1	37.9	75.6	177.5	395.4	165.9	559.6	24.1*	24.4
1965	48.3	251.9	40.5	83.3	193.7	444.6	173.2	630.9	26.9	25.1
1966	51.1	296.2	43.4	91.4	219.5	509.9	199.5	719.8	40.2	33.3
1967	55.1	323.2	46.5	92.5	239.1	574.8	219.1	791.1	33.1	36.9
1968	59.2	357.8	49.4	97.6	270.6	642.6	251.9	892.5	65.0	47.7
1969	62.9	399.7	51.8	101.2	294.4	738.4	282.4	1,020.7	47.0*	53.8
1970	57.4	372.5	46.4	93.4	270.0	693.6	275.0	966.6	58.1*	51.7
% CHANGE 1969-70	-8.7	-6.8	-10.4	-7.7	-8.3	-6.1	-2.6	-5.3	23.6	-3.9
AVG. RATE 1958-70	3.8	7.5	3.6	3.9	7.2	8.7	8.3	8.6	11.4	6.8

YEAR	RATIO OF VALUE ADDED TO SHIPMENTS	RATIO OF INVENTORIES TO SHIPMENTS	RATIO OF PAYROLL TO VALUE ADDED	VALUE OF SHIPMENTS PER PROD. WORKER ($000)	MANHOURS PER PRODUCTION WORKER (000)	WAGE PER PRODUCTION WORKER MANHOUR ($)	VALUE ADDED PER PRO. WORKER MANHOUR ($)	INDEX OF EMPLOYMENT (1967=100)	INDEX OF VALUE ADDED (1967=100)	INDEX OF SHIPMENTS (1967=100)
1958	.707	.065	.615	11.8	1.938	1.992	4.29	66.24	44.15	45.39
1959	.722	.047	.592	12.1	1.935	1.976	4.52	74.58	56.68	57.05
1960	.725	.044	.593	12.2	1.906	2.225	4.64	80.27	58.63	58.79
1961	.721	.044	.606	12.4	1.930	2.253	4.62	79.47	57.57	57.98
1962	.731	.038	.577	13.2	1.933	2.265	4.59	85.29	69.80	69.41
1963	.719	.043	.604	13.7	1.984	2.267	4.95	81.67	64.41	65.43
1964	.707	.044	.605	14.8	2.000	2.348	5.23	82.40	68.79	70.74
1965	.705	.041	.583	15.8	2.057	2.325	5.34	87.11	77.35	79.75
1966	.709	.046	.561	16.6	2.106	2.462	5.58	92.74	88.71	90.99
1967	.727	.047	.562	16.9	1.976	2.585	6.21	100.00	100.00	100.00
1968	.720	.051	.556	18.1	1.976	2.773	6.58	107.44	111.80	112.82
1969	.723	.053	.561	19.7	1.954	2.909	7.30	114.16	128.46	129.02
1970	.716	.053	.537	20.8	2.013	2.891	7.43	104.17	120.67	122.18
% CHANGE 1969-70	-0.8	1.3	-0.8	5.7	3.0	-0.6	1.8	-8.7	-6.1	-5.3
AVG. RATE 1958-70	0.1	-1.7	-1.1	4.9	0.3	3.2	4.7	3.8	8.7	8.6

Source: Annual Survey of Manufacturers - 1970. U.S. Department of Commerce.

Reproduced from best available copy.

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ENVIRONMENTAL PROTECTION AGENCY

ELECTROPLATING INDUSTRY

GENERAL INDUSTRY FINANCIAL STATISTICS

Item	Establishments (number)	All employees: Number (1,000)	All employees: Payroll (million dollars)	Production workers: Number (1,000)	Production workers: Man-hours (millions)	Production workers: Wages (million dollars)	Value added by manufacture (million dollars)	Cost of materials (million dollars)	Value of shipments (million dollars)	Capital expenditures, new (million dollars)	End-of-year inventories (million dollars)
3471-- PLATING AND POLISHING											
ESTABLISHMENTS, TOTAL	3 241	55.1	323.2	46.8	92.5	230.1	574.8	218.1	791.1	33.1	36.9
ESTABLISHMENTS WITH AN AVERAGE OF-											
1 TO 4 EMPLOYEES	1 237	2.3	12.0	2.2	3.8	9.8	26.8	8.9	35.7	.5	1.4
5 TO 9 EMPLOYEES	570	3.8	22.9	3.5	6.5	18.1	42.1	13.1	55.1	1.8	2.0
10 TO 19 EMPLOYEES	579	8.1	47.3	6.8	13.4	35.6	81.2	27.8	109.0	4.0	4.1
20 TO 49 EMPLOYEES	620	19.9	110.9	16.0	31.9	82.3	193.0	71.6	254.0	11.6	11.7
50 TO 99 EMPLOYEES	171	11.4	67.4	9.6	19.1	49.0	115.7	48.6	164.8	7.7	8.3
100 TO 249 EMPLOYEES	54	7.2	43.3	6.0	12.4	30.9	76.4	35.5	111.9	4.8	6.9
250 TO 499 EMPLOYEES	9	3.4	19.4	2.7	5.5	13.5	39.5	12.6	50.7	2.7	2.6

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Source: Census of Manufacturers-1967

EXHIBIT IV-2

ENVIRONMENTAL PROTECTION AGENCY

INDUSTRY SALES

Employment Range	Total Employees	Number of Establishments	Average Employees per Establishment	Value of Shipments ($ Million)	Average Sales Per Shop ($000)
1- 4	2,300	1,237	2	$ 35.7	$ 28.9
5- 9	3,800	570	7	55.1	96.7
10- 19	8,100	579	14	109.0	188.3
20- 49	18,900	620	30	264.0	425.7
50- 99	11,400	171	67	164.8	963.8
100-249	7,200	54	133	111.9	2,072.1
250-499	3,400	9	378	50.7	5,633.1
500 or More		1			
Totals	55,100	3,241	-	$791.1	244.1

Sources: Census of Manufactures, 1967
A. T. Kearney, Inc. Industry Survey

EXHIBIT IV-3

ENVIRONMENTAL PROTECTION AGENCY
ELECTROPLATING INDUSTRY
FINANCIAL STATEMENTS AND OPERATING RATIOS

SIC - 3471:

44 STATEMENTS ENDED ON OR ABOUT JUNE 30, 1972
72 STATEMENTS ENDED ON OR ABOUT DECEMBER 31, 1972

ASSET SIZE	UNDER $250M	$250M & LESS THAN $1MM	$1MM & LESS THAN $10MM	$10MM & LESS THAN $50MM	ALL SIZES
NUMBER OF STATEMENTS	42	44	28		116
ASSETS	%	%	%	%	%
Cash	8.8	7.8	4.9		4.6
Marketable Securities	.6	.2	.5		.4
Receivables Net	30.4	22.7	24.9		24.3
Inventory Net	8.5	9.2	21.2		21.5
All Other Current	4.1	1.3	.6		.7
Total Current	52.5	41.3	52.1		51.5
Fixed Assets Net	37.5	48.4	42.5		42.7
All Other Non-Current	10.0	10.3	5.5		5.8
Total	100.0	100.0	100.0		100.0
LIABILITIES					
Due To Banks-Short Term	11.1	4.4	4.5		4.4
Due To Trade	15.1	10.0	14.6		14.7
Income Taxes	2.5	1.3	2.5		1.5
Current Maturities LT Debt	4.6	4.1	2.6		1.6
All Other Current	12.0	10.0	7.0		4.9
Total Current Debt	45.4	29.8	31.2		27.1
Non-Current Debt, Unsub.	14.2	20.5	19.7		26.8
Total Unsubordinated Debt	59.5	50.3	50.9		54.0
Subordinated Debt	4.5	1.1	1.6		4.9
Tangible Net Worth	35.9	48.6	47.5		41.1
Total	100.0	100.0	100.0		100.0
INCOME DATA					
Net Sales	100.0*	100.0*	100.0*		100.0*
Cost Of Sales	63.9	71.2	77.3		77.2
Gross Profit	36.1	28.8	22.7		22.8
All Other Expense Net	32.3	24.8	17.7		18.4
Profit Before Taxes	3.8	4.0	5.0		4.4
RATIOS					
Quick	1.9 1.0 .5	1.6 1.0 .7	1.4 1.0 .7		1.6 1.0 .7
Current	2.1 1.3 .8	1.9 1.5 1.0	2.4 1.7 1.1		2.1 1.5 1.0
Fixed/Worth	.5 .9 2.1	.6 1.0 1.5	.5 .8 1.3		.5 .9 1.8
Debt/Worth	.6 1.6 4.1	.6 1.0 2.4	.5 .9 1.7		.6 1.0 2.5
Unsub. Debt/Capital Funds	.6 1.6 3.5	.6 1.0 2.1	.5 .9 1.7		.6 1.0 2.4
Sales/Receivables	29 12.4 41 8.8 63 5.7	36 10.1 48 7.5 57 6.3	36 10.1 43 8.3 57 6.3		35 10.4 44 8.1 58 6.2
Cost Sales/Inventory	14 25.4 27 13.5 77 4.7	14 26.6 26 14.1 49 7.3	25 14.5 43 8.4 69 5.2		15 23.5 32 11.4 60 6.0
Sales/Working Capital	10.5 5.1 -29.7	14.9 9.6 2.1	12.8 8.7 4.1		12.9 7.2 -41.1
Sales/Worth	9.2 5.4 3.1	6.1 4.1 2.3	5.2 3.5 1.9		7.0 4.2 2.5
% Profit Bef. Taxes/Worth	37.6 22.7 -2.8	26.8 13.1 4.6	37.1 15.4 7.8		35.2 16.5 5.9
% Profit Bef. Taxes/Tot. Assets	16.3 10.3 -.3	14.1 6.1 2.3	17.9 8.5 3.8		15.9 8.2 2.2
Net Sales Total Assets	$158820M 61198M	$423948M 246308M	$1105888M 533828M		$3317446M 1938528M

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41 STATEMENTS ENDED ON OR ABOUT JUNE 30, 1971
59 STATEMENTS ENDED ON OR ABOUT DECEMBER 31, 1971

ASSET SIZE	UNDER $250M	$250M & LESS THAN $1MM	$1MM & LESS THAN $10MM	$10MM & LESS THAN $25MM	ALL SIZES
NUMBER OF STATEMENTS	34	41	24		100
ASSETS	%	%	%	%	%
Cash	8.5	7.8	3.8		4.8
Marketable Securities	.8	.1	.8		1.0
Receivables Net	30.8	21.4	23.8		22.7
Inventory Net	11.1	8.1	22.8		19.5
All Other Current	1.8	1.3	5.3		3.8
Total Current	52.8	38.9	56.4		51.8
Fixed Assets Net	40.5	49.8	38.8		42.6
All Other Non-Current	6.7	11.2	5.0		5.8
Total	100.0	100.0	100.0		100.0
LIABILITIES					
Due To Banks-Short Term	10.2	4.1	4.7		4.3
Due To Trade	14.5	11.0	14.9		13.2
Income Taxes	2.6	1.3	1.8		1.6
Current Maturities LT Debt	5.8	4.3	2.0		2.8
All Other Current	12.3	9.4	5.9		6.8
Total Current Debt	45.3	30.1	29.1		28.1
Non-Current Debt, Unsub.	15.9	23.3	12.8		18.9
Total Unsubordinated Debt	61.2	53.4	41.8		47.0
Subordinated Debt	6.2	2.1	.8		1.1
Tangible Net Worth	32.5	44.4	57.9		51.8
Total	100.0	100.0	100.0		100.0
INCOME DATA					
Net Sales	100.0	100.0	100.0		100.0
Cost Of Sales	63.5	74.0	82.5		79.8
Gross Profit	36.5	26.0	17.5		20.2
All Other Expense Net	33.5	23.7	15.0		17.5
Profit Before Taxes	2.9	2.3	2.5		2.7
RATIOS					
Quick	1.5 .8 .4	1.4 1.1 .7	1.4 .9 .8		1.5 .8 .6
Current	2.1 1.3 .8	1.7 1.4 .9	2.2 1.8 1.4		2.1 1.5 .9
Fixed/Worth	.8 1.0 7.5	.7 1.0 2.1	.4 .8 1.0		.6 .9 2.5
Debt/Worth	.7 1.8 13.8	.5 1.2 2.8	.3 .8 1.3		.6 1.1 3.2
Unsub. Debt/Capital Funds	.7 1.2 7.8	.5 1.0 2.8	.3 .8 1.3		.6 1.0 2.8
Sales/Receivables	27 13.2 39 9.3 56 6.4	39 9.3 48 7.5 58 6.1	36 10.1 47 7.7 52 6.9		35 10.4 48 7.6 56 6.4
Cost Sales/Inventory	14 26.4 30 11.9 71 5.1	16 23.5 28 12.9 48 7.3	34 10.5 45 8.0 64 5.6		16 22.1 34 10.8 62 5.8
Sales/Working Capital	9.5 5.2 -10.0	16.8 7.9 -55.3	10.5 8.2 4.3		12.2 6.8 -61.8
Sales/Worth	7.2 5.2 3.2	4.7 3.2 2.4	4.5 3.2 2.4		5.8 3.8 2.5
% Profit Bef. Taxes/Worth	61.1 8.8 0	25.8 9.5 -2.2	23.2 9.3 2.2		27.1 8.8 -.7
% Profit Bef. Taxes/Tot. Assets	17.1 5.9 2.2	10.4 3.0 2.1	11.8 4.7 1.4		13.0 5.1 -.8
Net Sales Total Assets	$130862M 4890M	$355345M 21232M	$1250087M 65831M		$1882308M 1040808M

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42 STATEMENTS ENDED ON OR ABOUT JUNE 30, 1970
66 STATEMENTS ENDED ON OR ABOUT DECEMBER 31, 1970

ASSET SIZE	UNDER $250M	$250M & LESS THAN $1MM	$1MM & LESS THAN $10MM	$10MM & LESS THAN $25MM	ALL SIZES
NUMBER OF STATEMENTS	36	41	30		108
ASSETS	%	%	%	%	%
Cash	8.1	8.4	5.3		6.8
Marketable Securities	.4	1.7	.4		.8
Receivables Net	27.1	22.7	25.7		24.4
Inventory Net	12.7	12.1	22.0		21.4
All Other Current	1.1	3.5	1.9		2.0
Total Current	49.4	49.4	55.2		55.4
Fixed Assets Net	39.4	40.9	39.4		38.2
All Other Non-Current	11.3	9.7	5.3		6.4
Total	100.0	100.0	100.0		100.0
LIABILITIES					
Due To Banks-Short Term	8.7	4.9	6.8		8.2
Due To Trade	11.8	11.8	13.2		12.4
Income Taxes	2.8	3.2	2.7		2.6
Current Maturities LT Debt	3.1	2.3	3.8		3.0
All Other Current	9.1	9.0	5.1		5.8
Total Current Debt	38.0	31.1	31.4		30.1
Non-Current Debt, Unsub.	12.0	14.4	11.0		12.0
Total Unsubordinated Debt	48.1	45.5	42.4		42.1
Subordinated Debt	5.2	1.4	3.5		2.8
Tangible Net Worth	46.7	53.2	54.1		55.1
Total	100.0	100.0	100.0		100.0
INCOME DATA					
Net Sales	100.0	100.0	100.0		100.0*
Cost Of Sales	58.5	74.5	77.3		76.0
Gross Profit	41.5	25.5	22.7		24.0
All Other Expense Net	40.8	21.4	18.2		20.0
Profit Before Taxes	.8	4.1	4.5		4.0
RATIOS					
Quick	1.7 1.2 .8	1.7 1.1 .8	1.4 1.0 .7		1.8 1.1 .8
Current	2.2 1.6 1.1	2.2 1.5 1.0	2.5 1.7 1.3		2.3 1.8 1.1
Fixed/Worth	.5 .7 1.2	.5 .9 1.2	.4 .7 1.1		.5 .8 1.2
Debt/Worth	.6 1.0 1.7	.6 1.0 1.4	.4 .8 1.3		.5 .9 1.5
Unsub. Debt/Capital Funds	.5 .9 1.4	.5 .8 1.4	.4 .8 1.2		.5 .8 1.3
Sales/Receivables	30 12.1 38 9.5 49 7.3	32 11.3 43 8.3 52 6.9	36 10.1 49 7.3 58 6.2		32 11.4 41 8.7 53 6.8
Cost Sales/Inventory	15 24.0 27 13.2 88 6.5	10 36.1 31 11.6 48 7.5	34 10.5 47 7.8 71 5.1		14 25.1 33 10.8 61 5.9
Sales/Working Capital	14.6 8.4 [illegible]	19.8 6.6 -60.2	10.9 8.4 4.6		13.0 7.0 3.1
Sales/Worth	7.5 4.3 3.0	5.8 3.7 2.9	4.8 3.4 2.5		5.5 3.7 2.8
% Profit Bef. Taxes/Worth	21.2 8.0 -18.9	21.1 15.2 4.2	[illegible] [illegible] [illegible]		22.9 13.3 1.8
% Profit Bef. Taxes/Tot. Assets	10.8 3.0 -12.4	11.1 4.9 2.3	11.9 7.8 2.8		11.3 4.9 .8
Net Sales Total Assets	$120714M 4681M	$419332M 21262M	[illegible] [illegible]		$213732M 110257M

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Source: The Robert Morris Annual Statement Studies.

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EXHIBIT IV-4

ENVIRONMENTAL PROTECTION AGENCY

SUMMARY OF PROFITABILITY OF INDEPENDENT ELECTROPLATING SHOPS*

Type of Operation by Sales Dollars (000)	Profitability Percentage		
	Average	High	Low
Automatic General Metal Finishing			
$ 250-$ 499	.97%	4.00%	-5.80%
500- 749	3.39	5.85	1.20
1,000- 1,999	4.56	14.4	-1.32
>2,000	-10.40	4.0	-24.40
Manual General Metal Finishing			
$<100,000	1.30	11.20	-16.21
100-$ 249	3.38	10.6	-12.00
250- 499	1.42	5.98	-8.90
500- 749	2.22	6.20	-4.42
1,000- 1,999	.15	3.80	-9.00
Automatic Barrel Plating			
$ 250-$ 499	-2.02	5.48	-11.44
500- 749	4.76	11.64	-1.10
1,000- 1,999	4.8	5.0	4.8
Manual Barrel Plating			
$ 100-$ 749	5.25	6.80	3.70
1,000- 1,999	4.00	5.50	2.50
Hand Chrome Plating			
$ 100-$ 249	-1.14	12.50	-30.00
250- 749	3.28	9.53	-4.91
>1,000	5.71	22.40	-4.89

Note: * These profit values are based on the financial reports of 112 establishments. Because of the small sample size, average profits per process line cannot be considered representative.

Source: National Association of Metal Finishers, 1970 Survey

EXHIBIT IV-5

IV-26

ENVIRONMENTAL PROTECTION AGENCY

ANALYSIS OF L.T. DEBT/EQUITY ELECTROPLATING PLANTS

(000 omitted)

Company Number	Sales Volume	Number of Plating Employees	Long Term Debt	Terms	Equity	L.T. Debt-Equity	% Profit on Sales
6-42	$ 250	13	$ -	-	$ -	-	-
6-43	1,800	61	142	-	511	.3	-
6-44	1,875	71	800	10 years	-	-	-
6-46	342	12	125	10 years	27	4.6	5%
6-47	200	4	-	-	-	-	20%
6-48	200	5	200	-	-	-	25%
6-49	200	10	-	-	40	-	15%
6-50	100	5	30	3 years	-	-	-
6-51	250	9	-	-	61	-	6%
6-53	250	4	-	-	75	-	(4%)
6-54	450	9	21	6 years	71	.3	-
6-55	1,200	37	30	10 years	180	.2	2%
6-56	1,300	33	120	8 years	-	-	11%
6-57	100	7	-	-	50	-	-

Source: A. T. Kearney Survey

EXHIBIT IV-6

ENVIRONMENTAL PROTECTION AGENCY

BANK INTERVIEW SUMMARY

	Bank Code (1)	(2)	(3)	(4)	(5)
Type of Bank:	Medium-Large Central City Bank	Medium-Size Central City Bank	Large Central City Bank	Large Central City Bank	Small Neighborhood Bank
Knowledge of Industry	Familiar with Industry; Contact with one Electroplater	Accounts with Variety of Firms; No Specific Contact.	Familiar with Problems of Small Business; No Contact.	Accounts with Larger Firms; No Contact.	Familiar with Industry's Problems; Handles Six Accounts
Capital Availability for Pollution Control Equipment (PCM)	Currently: Difficult piece to Finance; Old Customers Preferred. Local Banks are the Usual Sources for Loans. Future: Bank Will Maintain Loan Standards.	No Financing Problems with (PCM) Bank's Funds are "Tight"; Old Customers Preferred.	No Financing Problem with (PCM). Local Banks May Be More Conservative Lenders.	No Financing Problem with (PCM). Forecasts "Tight" Money to End of Year; Old Customers Preferred.	Loans for (PCM) Usually Difficult to Get. Bank's Customers Average 3½-4% After-Tax Profits; Few Slightly More Profitable.
General Loan Requirements	Dependent on Reputation of Owner. Personal Guarantees and Cash Flows. 20% Equity Financing Customary.	Some Equity Required Depending on Reputation of Owner, Profitability and Business Net Worth.	Reputation of Principals Important. Equity, Needed; Personal Pledges for Smaller Companies.	Overall Ability to Service Debt Important. Personal Pledges Customary.	Historical Cash Cash Flows and 3-Year Growth Projections are Favored. Lien on Real Estate and Machinery Considered.
Cost of Capital	3% Over Prime Rate Depending on Company.	-	-	Up to 3% Over Prime Rate.	Companies with $250,000 sales = 10-10½%. Firms at $1,000,000 = 9-9½%. Prime = 8-9%.
Alternatives for Financing	Local Revenue Bonds, Special Depreciation Allowances and Tax Credits Considered. "Red Tape" with SBA Loans Discouraging.	SBA Loans, Local Bond Issues and Equity Financing from Suppliers.	Local Bond Issues, Special Pollution Bonds and SBA Loans are Sources.	SBA Loans and Local Bond Issues Possible Sources. Future Legislation Helpful.	Currently: Secondary Lenders at Greater Costs. Future: Improved SBA Loan Program

V - POLLUTION CONTROL REQUIREMENTS AND COSTS

Effluent limitations proposed by the Environmental Protection Agency (EPA) were developed on the basis of "best practicable control technology currently available" and "best practicable control technology economically achievable." In this report, best practicable technology is referred to as (BPT) and best available technology is referred to as (BAT). Effluent limitations guidelines and costs of attaining them are discussed in this section.

EFFLUENT LIMITATIONS GUIDELINES

Guidelines for the Electroplating Industry have been promulgated to cover new and existing plants discharging effluents to navigable waters. Proposed guidelines have been announced to cover plants discharging waste waters to municipal sewer systems. Point sources in the former group will be referred to as direct dischargers in the balance of this report. Point sources in the latter group will be referred to as municipal dischargers.

Effluent limitations fall into four categories for direct dischargers and municipal dischargers as follows:

- BPT
- BAT
- New Source Performance Standards
- Pretreatment Standards

The regulations provide for BPT standards to be met by 1977 and BAT to be in operation by 1983. Pretreatment standards are to be operational in 1977. New installations must meet new source standards immediately after a facility becomes operational.

(b) BPT Limitations

BPT Effluent Limitations are based upon existing technology specifically with chemical treatment and waste water clarification. The standards are shown in Exhibit V-1.

The following definitions relative to terms used in Exhibit V-1 have been provided by EPA and are included in paragraph 413.11 of Subpart A - Electroplating of Copper, Nickel, Chromium, and Zinc on Ferrous and Nonferrous Materials Subcategory of the regulations.

1. The term "sq m" shall mean the area plated with copper, nickel, chromium, zinc, or treated by chromating, expressed in square meters.

2. The term "sq ft" shall mean the area plated with copper, nickel, chromium, zinc, or treated by chromating, expressed in square feet.

3. The term "operation" shall mean any step in the plating process in which copper, nickel, chromium or zinc metal or chromate is deposited on a base material followed by a rinse.

Point sources to which standards apply are required to maintain production records expressed in square meters or square feet as defined on the preceding page. However, a plant may also use a surrogate for area plated, such as ampere hours used in plating.

(b) BPT Small Plant Limitation

For electroplating plants with production less than 33 square meters per hour, or installed direct current capacity of less than 2,000 amperes, BPT technology has been proposed to consist of cyanide destruction if any, chromium conversion, and pH reduction to range of 6.0 to 9.0 prior to discharge.

This variation was developed by EPA for small plants after consideration of the economic factors presented in the economic analysis of the proposed guidelines. The variation was designed to cover plants with fewer than five employees.

(c) BAT Limitation

The effluent limitation, based on "best available technology economically achievable," involves recovery and treatment to result in "no discharge of process waste water pollutants to navigable waters."

The regulations provide, upon application to EPA, for variation from the standards for plants with production of less than 120 square meters per hour. Point sources requiring the variation would be required to meet new source performance standards as described in the following paragraphs.

(d) New Source Performance Standards

New sources in the Electroplating Industry are defined as electroplating plants for which construction began after promulgation of proposed regulations. These plants are required to meet the effluent limits shown in Exhibit V-2.

(e) Pretreatment Standards

Pretreatment standards cover two categories of municipal dischargers as follows:

1. Pretreatment for new sources have been promulgated and require point sources in this category to meet guidelines established for New Source Direct Dischargers described above. The standards are shown in Exhibit V-2.

2. Pretreatment for existing sources have been proposed for municipal dischargers. The proposed guidelines are the same as BPT Guidelines which cover direct dischargers. The standards for BPT and proposed for pretreatment point sources are shown in Exhibit V-1.

INDUSTRY SEGMENTATIONS AND EFFLUENT LIMITATIONS

In establishing standards of performance for "best practical control technology" (BPT), electroplating shops were segmented in the development document prepared by Battelle Columbus Laboratories according to production capacity in terms of installed direct current capacity in amperes. Five plant sizes were established as follows:

Table V-1

Direct Current Capacity by Size of Shop

Size	Current Capacity in Amperes
Very large	Greater than 200,000
Large	50,000 - 200,000
Medium	10,000 - 50,000
Small	1,000 - 10,000
Very small	Less than 1,000

Source: Battelle Columbus Laboratories

Production in terms of area plated was related to direct current capacity in shops which Battelle studied. Industry economic data are not collected or published in this manner as discussed in Section III. Consequently, segmentation of the industry for the economic analysis is not practical by area plated for direct current capacity.

As previously discussed in Section III, available information for the electroplating shops provide a means of segmenting shops according to employment. Exhibit V-3 shows that some relationship does exist between the installed direct current capacity and the employment within shops. With some exception, very small shops tend to have small current capacities. The correlation, however, does not approach perfection. For example, a shop could have a large current capacity for technical reasons and thus be classified as a large shop, yet have low employment and low sales, as could be the case for a small hard chrome plater.

EFFLUENT LIMITATIONS USED FOR THIS STUDY

In order to evaluate the economic impact of pollution abatement requirements on the Electroplating Industry, it was necessary to apply effluent limitations to the Industry according to the size of plants as determined by the number of employees. The Industry has been subsegmented by size of employment in Exhibit V-4.

Two alternatives have been analyzed for the Industry. These are based on levels of treatment for direct dischargers and municipal plants in each size group.

(a) Alternate A - Effluent Limitations

The following levels of treatment were established for the Industry under Alternate A.

Table V-2

BPT and BAT - Direct Dischargers and Municipal Dischargers

Plant Group	BPT - 1977 Direct Dischargers	BPT - 1977 Municipal Dischargers	BAT - 1983 Direct Dischargers
A	BPT*	Pretreatment	BAT*
B	BPT	Pretreatment	BAT*
C	BPT	Pretreatment	BAT
D	BPT	Pretreatment	BAT
E	BPT	Pretreatment	BAT
F	BPT	Pretreatment	BAT

* Modified for small platers

Source: Environmental Protection Agency

(b) Alternate B Effluent Limitations

The levels of treatment shown in the following table were established for the Industry under Alternate B.

Table V-3

BPT and BAT - Direct Dischargers and Municipal Dischargers

Plant Group	BPT - 1977 Direct Dischargers	BPT - 1977 Municipal Dischargers	BAT - 1983 Direct Dischargers
A	BPT*	Pretreatment	BAT*
B	BPT	BPT	BAT*
C	BPT	BPT	BAT
D	BPT	BPT	BAT
E	BPT	BPT	BAT
F	BPT	BPT	BAT

*Modified for small platers

Source: Environmental Protection Agency

It is important to point out that under Alternate B municipal dischargers would be required to meet the same standards as direct dischargers. Alternate A differentiates between direct dischargers and municipal dischargers. Pretreatment costs used in the impact analysis were assumed to be lower than BPT costs; consequently, the cost impact is less under Alternate A for municipal dischargers than under Alternate B.

The proposed regulations for municipal dischargers provide that pretreatment be the same as BPT. Consequently, if proposed regulations are promulgated, Alternate B would be in effect.

WATER POLLUTION ABATEMENT COSTS

Costs for capital equipment to meet proposed effluent guidelines were developed from information supplied by the Environmental Protection Agency and developed for the EPA by Battelle Columbus Laboratories.

(a) BPT Investment Costs

Exhibit V-5 shows the investment costs for Alternate A, BPT pollution abatement equipment for direct dischargers and dischargers to municipal plants. These costs are based upon volume of water discharged as defined in Exhibit V-4. Exhibit V-5 indicates that BPT pollution abatement equipment investment costs range from a minimum of $25,000 for small direct discharge plants, Group A, 1 to 4 employees, to $1,436,000 for large plants, Group F, over 100 employees. Costs for firms discharging to municipal plants range from $25,000 to $718,000.

Exhibit V-6 shows the investment costs for Alternate B, BPT pollution abatement equipment for direct dischargers and municipal dischargers. Investment costs for this alternate are the same as for direct dischargers in Alternate A.

The table below summarizes investment costs for direct dischargers and firms discharging to municipal plants for BPT under Alternates A and B.

Table V-4

Summary of BPT Investment Costs

Plant Group	Alternate A		Alternate B
	Direct Dischargers	Municipal Dischargers	All Plants
A	$ 25,000	$ 25,000	$ 25,000
B	58,800	29,400	58,800
C	117,600	58,800	117,600
D	252,000	126,000	252,000
E	562,000	281,000	562,000
F	1,436,000	718,000	1,436,000

Source: Exhibit V-5 and V-6

Exhibit V-7 shows BPT equipment annual amortization costs for Alternate A, for direct dischargers and municipal dischargers. Exhibit V-8 shows BPT equipment annual amortization costs for Alternate B. Amortization costs are based on the assumption of a five-year depreciation and debt retirement period and a cost of capital of ten percent, which is what banks indicated is required. Although the same depreciation time period was used for all sizes of plants, it is recognized that larger plants may elect to use longer periods of time.

Exhibit V-9 shows Alternate A BPT investment costs for pollution abatement equipment for direct dischargers and municipal dischargers as a percentage of annual sales. Exhibit V-10 shows the same information for Alternate B.

For small plants in Alternates A and B, the investment cost as a percent of sales is 62 percent, while costs for the other groups average around 43 percent. Larger plants benefit from economies of scale in treatment facilities.

Direct dischargers in Alternate A and both groups in Alternate B have investment costs as a percent of sales ranging from 42 to 45 percent, with the exception of Plant Group A. However, for firms discharging to municipal plants in Alternate A the range is from 21 to 22 percent, again with the exception of Plant Group A.

Investment costs as a percent of annual sales for Alternates A and B for BPT are summarized in Table V-5 on the following page.

Table V-5

Summary of BPT Investment Costs as a Percent of Annual Sales

Plant Group	Alternate A Direct	Alternate A Municipal	Alternate B Direct and Municipal
A	62.0%	62.0%	62.0%
B	43.0	21.8	43.0
C	44.7	22.4	44.7
D	42.4	21.2	42.4
E	41.8	20.9	41.8
F	39.7	19.9	39.7

Source: Exhibit V-9 and Exhibit V-10

In both alternatives, small plants are at a distinct disadvantage. Although size group A plants have been granted a partial exemption, they still face a high treatment cost to sales ratio. This means these plants will either require longer periods to retire debt or greater price increases than the rest of the Industry. There may be some protection from competitive pressures if small plants are specialized or have other marketable services which buyers are willing to pay for, but the capital question remains. Unless longer term debt retirement periods are available to these plants, there may be a large number of closures, or periods with very small profits.

(b) BAT Investment Costs

Exhibit V-11 shows the capital investment costs to meet BAT pollution equipment requirements for both Alternate A and B.

This exhibit shows that for BAT investment, costs range from approximately $20,000 for Groups A and B to $684,000 for Group F.

Plant Groups A and B are not required to meet full BAT abatement of "no discharge of process waste waters pollutants to navigable waters." These groups are required to install water conservation methods only to reduce the quantity of pollutants to meet the recommended levels as shown in the guidelines. The costs associated with water conservation are estimated to be approximately $20,000.

Exhibit V-12 shows the annual amortization costs for BAT. These amortization costs are again based on a five-year repayment period and a cost of capital of 10 percent.

BAT requirements will only affect direct dischargers; consequently, no additional costs are estimated for the establishments discharging to municipal treatment systems in 1983.

BAT investment costs as a percent of annual sales are summarized in the following table.

Table V-6

Summary of BAT Investment Costs as a Percent of Annual Sales

Plant Group	Direct and Municipal Dischargers
A	50.0%
B	14.9
C	27.8
D	22.5
E	21.5
F	18.0

(c) BPT and Pretreatment Variable Operating Costs

Exhibit V-13 shows annual variable operating costs. Direct dischargers, Group A, 1 to 4 employees, have reduced treatment requirements and therefore lower operating costs. These costs are equal to pretreatment costs, which are one-half of BPT costs.

In Alternate A, direct discharge plant groups B, C, D, E and F, have operating costs based on meeting BPT. Municipal dischargers have costs based only on pretreatment.

In Alternate B, direct and municipal discharge plant groups B, C, D, E and F, have operating costs based on meeting BPT.

(d) BAT Variable Operating Costs

Exhibit V-14 shows variable operating costs for all plant groups which vary from $825 per year for the smallest shops to $70,700 for the largest shops.

EXHIBIT V-1

ENVIRONMENTAL PROTECTION AGENCY

EFFLUENT LIMITATIONS

BPT - 1977

Characteristic	Effluent Limitations Maximum for any 1 day	 Average of daily values for 30 consecutive days shall not exceed--
	Metric units (milligrams per square meters per operation)	
Cu	160	80
Ni	160	80
CrVI (Hexavalent)	16	8
Cr total	160	80
Zn	160	80
CN,A	16	8
CN, total	160	80
TSS (Total Suspended Solids)	4,800	3,200
pH	Within the range 6.0 to 9.5	
	English units (pounds per million square feet per operation	
Cu	32.7	16.4
Ni	32.7	16.4
CrVI (Hexavalent	3.3	1.6
Cr, total	32.7	16.4
Zn	32.7	16.4
CN,A	3.3	1.6
CN, total	32.7	16.4
TSS (Total Suspended Solids)	982.0	654.0
pH	Within the range 6.0 to 9.5.	

Source: EPA Effluent Guidelines

Reproduced from best available copy.

EXHIBIT V-2

ENVIRONMENTAL PROTECTION AGENCY

EFFLUENT LIMITATIONS

NEW SOURCES

Characteristic	Effluent Limitations Maximum for any 1 day	Average of daily values for 30 consecutive days shall not exceed--
	Metric units (milligrams per square meters per operation)	
Cu	80	40
Ni	80	40
CrVI (Hexavalent)	8	4
Cr, total	80	40
Zn	80	40
CN,A	8	4
CN,total	80	40
TSS (Total Suspended Solids)	2,400	1,600
pH	Within the range 6.0 to 9.5	
	English units (pounds per million square feet per operation	
	16.4	8.2
Cu	16.4	8.2
Ni	1.6	.8
CrVI (Hexavalent)	16.4	4.2
Zn	16.4	4.2
CN,A	1.6	.8
CN,total	16.2	4.7
TSS (Total Suspended Solids)	491.0	327.0
pH	Within the range 6.0 to 9.5.	

Source: EPA Effluent Guidelines

Reproduced from best available copy.

EXHIBIT V-3

V-16

ENVIRONMENTAL PROTECTION AGENCY

NUMBER OF PIANTS BY EMPLOYMENT AND RECTIFIER CAPACITY

Size of Plant by Number of Employees	Number of Plants				
	Rectifier Capacity				
	Very Small	Small 1,000 to 10,000	Medium 10,000 to 50,000	Large 50,000 to 20,000	Very Large 200,000
1 - 10	1	7	2	-	-
11 - 20	-	7	6	1	1
21 - 50	-	1	10	3	-
Over 50	-	-	5	7	1

Source: Battelle Columbus Laboratories
Environmental Protection Agency

EXHIBIT V-4

ENVIRONMENTAL PROTECTION AGENCY

DESCRIPTION OF PLANTS BY SIZE OF EMPLOYMENT

Model Plant	Number of Employees	Average Number of Employees Per Establishment(1)	Annual Sales Range	Average Sales Per Establishment(2)	Average Water Usage (3) (GPH)
A	1 - 4	2	$ 0 - 100	$ 40.3	300
B	5 - 9	7	100 - 300	135.0	1,050
C	10 - 19	14	300 - 500	263.0	2,100
D	20 - 49	30	500 - 900	594.0	4,500
E	50 - 99	67	900 - 2,000	1,345.5	10,050
F	Over 100	171	2,000 - 8,000	3,613.0	25,650

Assumptions:

Plating - 60 sq. ft./hour/employee
Water - 2.5 gallons/sq. ft.
Source: Environmental Protection Agency

Formula - Water Usage (GPH) = 60 sq. ft./hour/employee x 2.5 gallons/sq. ft. x number of employees.

Sources:
(1) U.S. Census of Manufactures - 1967
(2) A. T. Kearney, Inc.
(3) Battelle Columbus Laboratories

EXHIBIT V-5

V-18

ENVIRONMENTAL PROTECTION AGENCY

ALTERNATE A

INVESTMENT COSTS FOR BPT POLLUTION ABATEMENT EQUIPMENT

Direct Dischargers and Municipal Dischargers

Plant Group	Employment Range	Average Number of Employees per Group	Average Investment Costs Direct Dischargers	 Municipal Dischargers
A	1 - 4	2	$ 25,000*	$ 25,000
B	5 - 9	7	58,800	29,400
C	10 - 19	14	117,600	58,800
D	20 - 49	30	252,000	126,000
E	50 - 99	67	562,000	281,000
F	Over 100	171	1,436,000	718,000

Assumptions:

Plating - 60 sq. ft./hour/employee

Water Usage - 2.5 gallons/sq. ft. plated

Investment Cost - $56,000/1,000 gallons/hour - Minimum Cost $50,000 for direct dischargers.

- $28,000/1,000 gallons/hour - Minimum Cost $25,000 for municipal dischargers

Source: Environmental Protection Agency.

Formula:

Investment Cost - 60 sq. ft./hour/employee x 2.5 gallons/sq. ft. x $56,000 or $28,000/1,000 gallons/hour x Number of Employees.

* Small plant variation reduces minimum costs to $25,000 for Group A plants.

Source: Environmental Protection Agency

EXHIBIT V - 6

ENVIRONMENTAL PROTECTION AGENCY

ALTERNATE B

INVESTMENT COSTS FOR BPT POLLUTION AVATEMENT EQUIPMENT

All Plants

Plant Group	Employment Range	Average Number of Employees Per Group	Investment Costs
A	1 - 4	2	$ 25,000 *
B	5 - 9	7	58,800
C	10 - 19	14	117,600
D	20 - 49	30	252,000
E	50 - 99	67	562,000
F	Over 100	171	1,436,000

Assumptions:

Plating - 60 sq. ft./hour/employee

Water Usage - 2.5 gallons/sq. ft. plated

Investment Cost - $56,000/1,000 gallons/hour - Minimum Cost of $50,000

Source: Environmental Protection Agency

Formula:

Investment Cost = 60 sq. ft./hour/employee x 2.5 gallons/ sq. ft. x $56,000/1,000 gallons/hour x Number of Employees

* Small plant variation reduces minimum cost to $25,000 Group A plants.

Source: Environmental Protection Agency

EXHIBIT V-7

V-20

ENVIRONMENTAL PROTECTION AGENCY

ALTERNATE A

ANNUAL AMORTIZATION COSTS OF INVESTMENTS FOR BPT

	Municipal Dischargers Costs		Direct Dischargers Costs	
Group	Investment	Amortization	Investment	Amortization
A	$ 25,000	$ 6,595	$ 25,000	$ 6,595
B	29,400	7,650	58,800	15,300
C	58,800	15,511	117,600	31,023
D	126,000	33,238	252,000	66,477
E	281,000	74,127	562,000	148,254
F	718,000	189,460	1,436,000	378,919

Assumptions:

Cost of Capital - 10%

Payback Period - 5 years

Sources:

Exhibit V-3
A. T. Kearney, Inc.

EXHIBIT V-8

ENVIRONMENTAL PROTECTION AGENCY

ALTERNATE B

ANNUAL AMORTIZATION COSTS OF INVESTMENTS FOR BPT

Direct Dischargers and Municipal Dischargers

	Costs	
Group	Investment	Amortization
A	$ 25,000	$ 6,595
B	58,800	15,300
C	117,600	31,023
D	252,000	66,477
E	562,000	148,254
F	1,436,000	378,919

Assumptions:

Cost of Capital - 10%

Payback Period - 5 years

Sources:

Exhibit V-4
A. T. Kearney, Inc.

EXHIBIT V-9

ENVIRONMENTAL PROTECTION AGENCY

Alternate A

BPT Investment Costs as a Percent of Annual Sales for Direct Dischargers and Municipal Dischargers

Plant Group	Average Sales $ .000	Investment		Investment	
		Per Plant	% of Sales	Per Plant	% of Sales
A	40.3	$ 25,000	62.0%	$ 25,000	62.0 %
B	135.0	58,800	43.0	29,400	21.8
C	263.0	117,600	44.7	58,800	22.4
D	594.0	252,000	42.4	126,000	21.2
E	1,345.5	562,000	41.8	281,000	20.9
F	3,613.0	1,436,000	39.7	718,000	19.9

Sources: Exhibit V-4 and V-5

EXHIBIT V-10

V-23

ENVIRONMENTAL PROTECTION AGENCY

Alternate B

BPT Investment Costs as a Percent of Annual Sales for Direct Dischargers and Municipal Dischargers

Plant Group	Average Sales $ .000	Investment Per Plant (1)	Investment % of Sales
A	40.3	$ 25,000	62.0%
B	135.0	58,000	43.0
C	263.0	117,600	44.7
D	594.0	252,000	42.4
E	1,345.5	562,000	41.8
F	3,613.0	1.436,000	39.7

Source: (1) Exhibit V-6

EXHIBIT V-11

ENVIRONMENTAL PROTECTION AGENCY

INVESTMENT COSTS FOR BAT POLLUTION ABATEMENT EQUIPMENT

Group	Average Number of Employees Per Group	Number of Gallons/Hour	Investment Cost		
			Reverse Osmosis	Evaporative Recovery	Total
A	2	300	-	-	$ 20,000
B	7	1,050	-	-	20,000
C	14	2,100	$ 48,000	25,000	73,000
D	30	4,500	96,000	37,500	133,500
E	67	10,050	205,000	83,800	288,800
F	168	25,650	467,000	181,600	648,600

Assumptions:

Reverse Osmosis Costs based on - minimum $8,000 for 125 gallon/hour shop - $14,000 for 275 gallon/hour shop and $125,000 for 6,000 gallon/hour shop.

Evaporative Recovery Costs based on - minimum of $25,000 for 300 gallons - Evaporative Recovery Unit handles 10% of gallons per hour of reverse osmosis.

- For Groups A and B assume $20,000 cost for water conservation methods.

Source: Environmental Protection Agency

EXHIBIT V-12

V 25

ENVIRONMENTAL PROTECTION AGENCY

ANNUAL AMORTIZATION COST OF INVESTMENTS FOR BAT POLLUTION ABATEMENT EQUIPMENT

Plant Group	Costs	
	Investment	Amortization
A	$ 20,000	$ 5,280
B	20,000	5,280
C	73,000	19,260
D	133,500	35,224
E	288,800	76,200
F	648,600	171,099

Source: Exhibit V-11
A. T. Kearney, Inc.

EXHIBIT V-13

ENVIRONMENTAL PROTECTION AGENCY

ALTERNATE A & B

ANNUAL OPERATING COSTS FOR BPT POLLUTION ABATEMENT EQUIPMENT

Group	Employment Range	Average Number of Employees Per Group	Alternate A Direct	Alternate A Municipal	Alternate B Direct and Municipal
A	1 - 4	2	$ 795	$ 795	$ 795
B	5 - 9	7	5,565	2,790	5,565
C	10 - 19	14	11,130	5,565	11,130
D	20 - 49	30	23,850	11,925	23,850
E	50 - 99	67	53,265	26,635	53,265
F	Over 100	171	135,945	67,973	135,945

Assumptions:

Plating - 60 sq. ft./hour/employee
Operating Cost - $5.30/1000 sq. ft. plated
Annual Hours - 2500 hours/year/employee
Alternate A Urban assumed to be one half of rural costs
Source: Environmental Protection Agency

Formula:

Annual Operating Costs = 60 sq. ft./hour/empl. x $5.30/1000 sq. ft. x number of employees x 2500 hours/yr./empl.

Source: Environmental Protection Agency

EXHIBIT V-14

V-27

ENVIRONMENTAL PROTECTION AGENCY

Alternates A & B

Annual Operating Costs for BAT Pollution Abatement Equipment

Group	Employment Range	Average Number of Employees Per Group	Annual Operating Costs
A	1 - 4	2	$ 825
B	5 - 9	7	2,895
C	10 - 19	14	5,790
D	20 - 49	30	12,405
E	50 - 99	67	27,705
F	Over 100	171	70,700

Assumptions:

$0.0474 per man-hour for reverse osmosis
$0.1180 per man-hour for evaporator
2500 man-hours per year per employee

Source: Environmental Protection Agency

Formula:

Operating Costs = ($0.0474 + 0.1180) X 2500 man-hours/yr. X number of employees.

Source: Environmental Protection Agency

VI - PRICE EFFECTS

In order to determine the potential changes in prices attributable to the cost of pollution abatement, it is necessary to examine the various methods of costing used in both independent and captive electroplating shops. In addition, the economics of various alternatives facing the purchasers of plating services must be examined. By analyzing the costing methods in supplying plating services and the demand for such services, the impact on cost and prices may be identified.

Because entry costs are low and there is an abundance of electroplating services offered, plating services are competitively priced. Utilizing the most significant variable cost and the market price, an establishment owner determines his price. Those firms which operate in highly competitive areas, such as zinc plating of nuts and bolts, may reduce their profit margins to maintain competitive pricing of their services.

PRICING IN INDEPENDENT SHOPS

There are basically three methods used in the pricing of services in independent plating shops:

1. Labor based costing is the most frequently used method in determining the price of services. Deriving multiples of labor costs for the different categories of plating services is predominantly used in the labor intensive independent shops.

For example, in Exhibit VI-1, it is noted that the direct labor cost in an average independent electroplating firm represents about 28 percent of the sales dollar. Pricing of jobs is shown at approximately 3.6 times the direct labor cost for the plating process. However, this multiple of labor will vary with the type of a plating service that is required.

2. Equipment based pricing is used in automatic plating shops and in shops which plate hard chrome. In these cases, the equipment cost is a significant portion of the cost expenditures. Since there is a high investment in automatic equipment, the cost per equipment hour is charged in addition to that of the hourly labor cost used in operation of this equipment.

When plating with hard chrome, jobs remain in the plating tanks for extended lengths of time (sometimes days) and the costs are based on the use of the tanks for the time the parts are in the units, and for the labor time for preparation of the parts.

3. Area of surface plated is the least used method of pricing plating services. This method is used primarily in the pricing of plating precious metals, such as gold, silver, platinum, and other precious metals which are frequently evaluated on the basis of surface area plated.

According to the industry averages presented in Exhibit VI-1, pretax profit on sales has been about 5.9 percent. Another measure of financial strength is the return on invested capital. As a rough guide, investment capital is approximately 83 percent of annual sales for the firms represented by the National Association of Metal Finishers Study (Exhibit VI-2). If this figure is true for the industry as a whole, the industry average pretax return-on-investment is approximately 7.0 percent (Exhibit VI-3). As the amount of capital investment increases, prices would have to increase proportionately in order to maintain the same level of return-on-investment.

There is reluctance among the banking community to lend money for the purpose of investing in nonproductive assets. Many operators of electroplating establishments are faced with the serious problem of deciding whether to continue to maintain their entire electroplating product line and make the investment in pollution control, or eliminating process lines associated with additional pollution controls costs, or closing.

OTHER FACTORS OF CONSIDERATION

It has been previously stated that the price of plating services is a function of the significant variable cost factor. As operating costs go up, prices also will have to increase as long as volume remains constant and the rate of return does not change. Of even greater significance than the cost aspect of plating is what will happen to competition in the Electroplating Industry with the advent of increased pollution controls. In the future there will be two levels of pollution requirements - existing facilities which are required to operate under one kind of restriction, and new sources which are required to operate under another. This has the effect of restricting entrance into the industry because of the higher capital investment required to begin a plating business. In addition, some firms are unwilling to make the capital investment and thus may elect to leave the industry.

Plating firms in some cases are eliminating plating services that are highly polluting. Lead and cadmium plating have been reduced or eliminated in some independent plating shops as well as in captive facilities.

Aside from the effects of restricted entry, the higher cost of operations could potentially yield significantly higher prices for plating services. However, such increases may not be tolerated by the customers of plating services. There may be some substitution for plating services when prices of plating services are increased. Other types of plating may be sought; for example, changing from combined copper, nickel, chrome plating to a more economical but less desirable process of plating; or other types of finishes may be sought such as painting or galvanizing. In addition, materials which do not require plating may also be used, such as stainless steel, aluminum, or plastics. As discussed in Section III, the substitution impact is not expected to be significant. The similar pollution control problems and impacts on costs are expected to exist in other industries and for other processes were substitute materials or coatings may originate. This will tend to minimize the price benefits which may be achieved through such substitituions.

PLANT SIZE PARAMETERS

In order to assess the price effects of pollution abatement on electroplating job shops, plants were grouped according to size of employment. Size plant categories were developed based on employment size. Sales and number of employees were reasonably correlated in several industry studies and these values were presented in Exhibit V-4. These size categories were then used to segment the industry in the impact analysis.

Profits which were previously discussed, have been presented according to the size of each plant group. Exhibit VI-4 shows the profits by size of firms.

This exhibit also details the average sales and the number of plants according to U.S. Census of Manufactures statistics for 1967. The sales reported in the Census records were adjusted to reflect price levels in 1972. Average pretax profits for each segment were derived from an industry survey which is described in Section IV.

PROFIT COMMITMENT FOR POLLUTION CONTROL

In order to meet the costs of capital investment and operation for control abatement, firms will either maintain current prices and pay for equipment out of existing profits, or raise prices to offset part or all of the added costs. The decision will be based on many factors including competition, customer reaction, and level of present profitability. Cash flow within the firm must also be sufficient to cover the interst and loan payments of the pollution control investment.

(a) Maintaining Present Prices

The ability to maintain present prices depends upon the cash flow and profit characteristics of the electroplating firms. Future profits and cash flow must adequately cover the payments for installation and operation of pollution abatement equipment.

Industry sources indicate that it has been a general rule in the industry that investments for plating equipment are made committing up to 1.5 years of profits.

While this decision rule is used for normal production equipment, which is expected to provide increased profits, it is probably not applicable to pollution abatement equipment. The decision to provide additional production or replacement equipment does not normally affect the actual survival of the business. However, the decision to install or not install pollution abatment equipment may affect the survival of the business. Consequently, it is reasonable to assume that the industry's investment in pollution abatement equipment could represent a greater number of years of profit commitment. This period, based on comments by industry sources, has been determined to be about five years.

The cash flow of the firm which includes profits, is also important in determining the establishment's ability to meet its financing payments. Without a price increase the present cash flow would be required to provide for interest and principal payments on equipment and additional operating expenses. Under these circumstances many plants may exercise the option to close rather than sacrifice profits and cash flows.

The industry capacity would be reduced as a result of these closures. It is difficult to determine the direct effects of this possible reduction in number of establishments on pricing since there is an insufficient knowledge of the demand function. However, it is safe to assume any or several of the following will occur:

1. Substitution of other materials or coatings for electroplating.
2. Absorption of business of closed shops by captive shops.

3. Absorption of business of closed shops by remaining independent shops.

4. Price increases to cover costs of pollution abatement.

It is not practical to assume that no price increases will take place. Most shops would, in fact, increase prices to meet part or all of the costs of pollution abatement with the amount of price increases depending on competitive pressures. The amount of actual increases by each plant will depend on their local markets, decisions of the owner regarding remaining in business and other variable factors.

(b) Increased Costs to Cover Pollution Abatement

Very few plants in the industry are presently meeting the Pretreatment requirements, and practically none are meeting the BPT and BAT standards expected to be applied in 1977 and 1983. For these reasons, operating costs for pollution abatement have not been compiled on an industry-wide basis. Some plants are, however, meeting local standards but there is no cost data for their operations.

For the purposes of this study, the annual operating costs for BPT and BAT pollution abatement were based on information furnished by the Environmental Protection Agency. These costs were discussed in Section V and shown on Exhibits V-13 and V-14. The exhibits show that for BPT, annual operating costs for direct dischargers range from approximately $800 for plant group A to $53,000 for plant group E for Alternates A and B. For Alternate A - municipal dischargers, the operating costs are approximately one-half of the direct discharger costs in groups B through F. For BAT, annual operating costs range from approximately $800 to $28,000 for the same size plants.

As previously noted, some plants in Kearney's survey have compiled data for operating costs for pretreatment. An average cost of 1.7 percent of annual sales has been found to be required for these annual operating costs. If we are to assume that annual operating costs for BPT abatement are approximately twice the costs for pretreatment, a reasonable correlation is found between calculated and experienced pretreatment costs. This comparison is shown in the table on the following page.

Table VI-1

Comparison of Survey and Calculated Annual Operating Costs

Plant Group	Average Sales Dollars Per Group	Pretreatment Operating Costs @ 1.7% of Sales	Pretreatment Operating Costs @ 50% of BPT
A	40.3	$ 685	$ 795
B	135.0	2,295	2,790
C	263.0	4,470	5,565
D	594.0	10,100	11,925
E	1,345.5	22,875	26,635

Source: Exhibits V-13, V-14
A. T. Kearney Industry Survey

(c) Price Increases to Meet Pollution Control Requirements

The following percent price increases will be required to offset the capital equipment costs and variable operating costs discussed in Section V.

Table VI-2

Percent Price Increases - BPT and BAT

	Alternate A		Alternate B	
Level	Direct Dischargers	Municipal Dischargers	Direct Dischargers	Municipal Dischargers
BPT	15.5%	8.3%	15.5%	15.5%
BAT	8.4	-	8.4	-

Source: Exhibits VI-7 thru VI-10

The price increases required to maintain present profitability are based on five year financing at 10 percent interest. The loan terms are typical for equipment purchases according to several banks which were contacted during the study. Larger establishments may obtain longer term financing due to collateral and cash flow characteristics.

Exhibit VI-5 and VI-6 have been prepared to indicate the extent of increases needed for firms in each plant size group for Alternates A and B to maintain present absolute dollar profits. The exhibits breakdown the increases for BPT and BAT. Exhibits VI-7, VI-8, VI-9, and VI-10 show the calculations used to arrive at the estimated price increases.

The impact of the implied price increases required for the different plant size and types is important. Price increases required are higher for the small plant size. Therefore, a competitive advantage will exist for the larger plants, which could have a long-term effect on the viability of the very small shops.

Price increases also vary for each alternate considered. According to Alternate B the price increases would vary only according to plant size. There would be no price differentiation between municipal and direct dischargers because the regulations would be the same for both groups. Alternate B represents the currently proposed and promulgated regulations. However, Alternate A distinguishes between direct and municipal dischargers concerning treatment requirements, and thus price increases differ for each group. The municipal dischargers require only half the price increase of the direct dischargers. For direct dischargers and municipal dischargers competing in the same markets, the cost differential will severely impact the direct dischargers. In most instances they will be forced to close or move to a municipal system. This problem may not be as acute as it appears if direct dischargers are located in rural areas. In this event, transportation costs could have a buffering effect on the competition which could come from the lower cost municipal plants.

EXHIBIT VI-1

VI-13

ENVIRONMENTAL PROTECTION AGENCY

INCOME STATEMENT PROFILE(1)

Cost Elements	Percent of Sales
Production Expense	
Labor - Direct	27.7
Labor - Indirect	4.7
Materials	16.4
Rent	2.6
Utilities	5.2
Repair and Maintenance	2.8
Delivery Expense	2.0
Other Production Expense	9.0
Total Production Expense	70.4
Sales Expense	
Salaries	1.8
Other Sales Expense	1.8
Total Sales Expense	3.6
General and Administrative Expense	
Owner/Officer's Salary	9.4
Office Salary	3.3
Office General and Administrative	7.3
Total General	20.0
Total Expenses	94.1
Profit Before Taxes	5.9
Profit After Taxes	3.0

Notes: (1) Source: National Association of Metal Finishers Cost Survey 1970, adjusted to reflect plating firms only.

EXHIBIT VI-2

VI-14

ENVIRONMENTAL PROTECTION AGENCY

ESTIMATED CAPITALIZATION OF METAL FINISHING FIRMS (1)

Type of Metal Finishing	Capitalization NAMF	Capitalization Industry
Precious metals	217,000	46,100
Buffing and polishing	141,300	28,800
Chrome	224,700	47,700
General platters	300,000	63,100
Average capitalization at chrome and general platters(2)	262,350	55,400
Average yearly sales of NAMF members(3)	317,000	
Capitalization as a percent of sales (4)	83%	

Notes: (1) Based on 1966 University of Michigan Study

(2) Derived as follows: (224,700 + 300,000)/2 = 262,350

(3) Derived from University of Michigan Study:
18% industry members at NAMF
77% of industry sales from NAMF
Gross industry billings of $200,000,000
2700 firms in industry
(200,000,000 x 77%)/(18% x 2700) = $317,000

(4) Derived by dividing average capitalization by average sales.

EXHIBIT VI-3

ENVIRONMENTAL PROTECTION AGENCY

ELECTROPLATING INDUSTRY

ESTIMATED RETURN ON INVESTMENT OF METAL FINISHING FIRMS

Element	Measure
Index of Average Yearly Sales (3)	100.00
Index of Capitalization (1)	83.00
Margin on Sales (pre tax) (2)	5.9%
Return on Capitalization (3)	7.1%

Notes: (1) See Exhibit V-2

(2) See Exhibit V-1

(3) Derived by dividing pre tax profit margin by capitalization: 5.9/83.00 = 7.1%

EXHIBIT VI-4

ENVIRONMENTAL PROTECTION AGENCY

AVERAGE PRE-TAX PROFIT OF INDEPENDENT PLANTS (Less Than 100 Employees)

Model Plant Code	Average Sales Per Establishment(1) ($ Thousand)	Number of Establishments	Average(2) Pre-Tax Profit (Percent of Sales)
A	40.3	924	9.0%
B	135.0	426	6.5
C	263.0	433	4.9
D	594.0	463	7.2
E	1,345.5	128	4.2
Total		2,374	5.9

Notes: (1) Average sales derived from U.S. Census of Manufactures Data and adjusted to reflect 1972 price levels.

(2) Based on Kearney study of industry.

Sources: National Association of Metal Finishers
U.S. Census of Manufactures, 1967
A. T. Kearney, Inc.

EXHIBIT VI-5

VI-17

ENVIRONMENTAL PROTECTION AGENCY

ALTERNATE A

ESTIMATED PRICE INCREASES FOR TREATMENT LEVELS

Plant Code	BPT Level I (Direct Dischargers)	BPT Level I (Municipal Dischargers)	BAT Level II (Direct Dischargers)
A	18.3%	18.3%	15.1%
B	15.5	7.7	6.1
C	16.0	8.0	9.5
D	15.2	7.6	8.0
E	15.0	7.5	7.7
Weighted Average	15.5%	8.3%	8.4%

Source: A. T. Kearney

EXHIBIT VI-6

VI-18

ENVIRONMENTAL PROTECTION AGENCY

ALTERNATE B

ESTIMATED PRICE INCREASES FOR TREATMENT LEVELS

Plant Code	BPT Direct and Municipal Dischargers	BAT Direct Dischargers
A	18.3%	15.1%
B	15.5	6.1
C	16.0	9.5
D	15.2	8.0
E	15.0	7.7
Weighted Average	15.5	8.4%

Source: A. T. Kearney

EXHIBIT VI-7

ENVIRONMENTAL PROTECTION AGENCY

ALTERNATE A

POTENTIAL COST INCREASE FOR MUNICIPAL PLANTS FOR BPT POLLUTION ABATEMENT

Plant Code	Number of Employees	Number of Plants	Annual Amortization Costs		Annual Operating Costs		Total Annual Costs ($ .000)	Sales ($ .000)		Cost Increase as Percent of Sales
			Per Plant	All Plants ($ .000)	Per Plant	All Plants ($ .000)		Per Plant	All Plants	
A	1-4	711	$ 6,595	$ 4,689.0	$ 795	$ 565.2	$ 5,254.2	$ 40.3	$ 28,653.3	18.3%
B	5-9	328	7,650	2,509.2	2,780	911.8	3,421.0	135.0	44,280.0	7.7
C	10-19	333	15,512	5,165.5	5,565	1,853.1	7,018.6	262.9	87,545.7	8.0
D	20-49	357	33,238	11,866.0	11,925	4,257.2	16,123.2	594.3	212,165.1	7.6
E	50-99	99	74,127	7,338.6	26,630	2,636.4	9,975.0	1,345.5	133,204.5	7.5
Total		1,828		$31,568.3		$10,223.7	$41,792.0		$505,848.6	8.3%

Source: A.T. Kearney.

EXHIBIT VI-8

ENVIRONMENTAL PROTECTION AGENCY

ALTERNATE B

POTENTIAL COST INCREASE FOR MUNICIPAL PLANTS FOR BPT POLLUTION ABATEMENT

Plant Code	Number of Employees	Number of Plants	Annual Amortization Costs		Annual Operating Costs		Total Annual Costs ($ .000)	Sales ($ .000)		Cost Increase as Percent of Sales
			Per Plant	All Plants ($ .000)	Per Plant	All Plants ($ .000)		Per Plant	All Plants	
A	1-4	711	$ 6,595	$ 4,689.0	$ 795	$ 565.2	$ 5,254.2	$ 40.3	$ 28,653.3	18.3%
B	5-9	328	15,300	5,018.4	5,565	1,825.3	6,843.7	135.0	44,280.0	15.5
C	10-19	333	31,023	10,330.7	11,130	3,706.3	14,037.0	262.9	87,545.7	16.0
D	20-49	357	66,477	23,732.3	23,850	8,514.5	32,246.8	594.3	212,165.1	15.2
E	50-99	99	148,254	14,677.1	53,265	5,273.2	19,950.3	1,345.5	133,204.5	15.0
Total		1,828		$58,447.5		$19,884.5	$78,332.0		$505,848.6	15.5%

Source: A.T. Kearney.

EXHIBIT VI-9

ENVIRONMENTAL PROTECTION AGENCY

ALTERNATES A AND B

POTENTIAL COST INCREASE FOR DIRECT DISCHARGERS FOR BPT POLLUTION ABATEMENT

Plant Code	Number of Employees	Number of Plants	Annual Amortization Costs		Annual Operating Costs		Total Annual Costs ($ .000)	Sales ($ .000)		Cost Increase as Percent of Sales
			Per Plant	All Plants ($ .000)	Per Plant	All Plant ($ .000)		Per Plant	All Plants	
A	1-4	213	$ 6,595	$ 1,404.7	$ 795	$ 169.3	$ 1,574.0	$ 40.3	$ 8,583.9	18.3%
B	5-9	98	15,300	1,499.4	5,565	543.4	2,042.8	135.0	13,230.0	15.4
C	10-19	100	31,023	3,102.3	11,130	1,113.0	4,215.3	262.9	26,290.0	16.0
D	20-49	106	66,477	7,046.6	23,850	2,528.1	9,574.7	594.3	62,995.8	15.2
E	50-99	29	148,254	4,299.4	53,265	1,544.7	5,844.1	1,345.5	39,019.5	15.0
Total		546		$17,352.4		$5,898.5	$23,250.9		$150,119.2	15.5%

Source: A. T. Kearney.

ENVIRONMENTAL PROTECTION AGENCY

ALTERNATES A AND B

POTENTIAL COST INCREASE FOR DIRECT DISCHARGERS FOR BAT POLLUTION ABATEMENT

Plant Code	Number of Employees	Number of Plants	Per Plant	All Plants	Per Plant	All Plants	Total Annual Cost	Per Plant	All Plants	Cost Increase as Percent of Sales
A	1-4	213	$ 5,280	$1,124.6	$ 825	$ 175.7	$1,300.3	$ 40.3	$ 8,583.9	15.1%
B	5-9	98	5,280	517.4	2,895	283.7	801.1	135.0	13,230.0	6.1
C	10-19	100	19,260	1,926.0	5,790	579.0	2,505.0	262.9	26,290.0	9.5
D	20-49	106	35,244	3,735.9	12,405	1,314.9	5,050.8	594.3	62,995.8	8.0
E	50-99	29	76,200	2,209.8	27,705	803.4	3,013.2	1,345.5	39,019.5	7.7
Total		546		$9,513.7		$3,156.7	$12,670.4		$150,119.2	8.4%

Source: A. T. Kearney.

vi-22

EXHIBIT VI-10

VII - IMPACT ANALYSIS

SEGMENT OF THE INDUSTRY COVERED BY THIS ANALYSIS

The Electroplating, Polishing and Coating Industry as covered by SIC 3471 has been identified has having 3,241 establishments and 55,100 employees in 1967. However, it is estimated that only 2,423 of the establishments and 42,331 of the employees (1967) are platers of copper, nickel, chromium and zinc. The surveys of the industry confirmed that none of the largest plants, 100 or more employees, were likely to be affected seriously by the requirements and costs of pollution abatement. Therefore, the number of establishments which were included in the impact exhibits in this section were reduced to 2,374, and the number of employees to 33,749.

IMPACTS TO BE CONSIDERED

The impact analysis has taken into consideration the following principal factors:

1. Capital and operating costs for pollution abatement.
2. Increase of prices of plating services.
3. Impact of increased prices on demand for services and potential plant closures.
4. Impact of capital requirements on potential plant closures.

5. Estimates of plant closures.

6. Estimates of employment dislocations caused by closures.

7. Effects of closures on communities.

8. Effects of closures on production capacity.

These are discussed in the various paragraphs of this section of the study.

ALTERNATE EFFLUENT LIMITATION GUIDELINES

The impact analysis is performed for two alternative standards, A and B, which were discussed in Section V. Alternative B reflects the guidelines as currently proposed.

(a) Alternate A

Assumptions:

1. Plant groups A through E discharging to municipal sewer systems will be required to meet pretreatment standards* in 1977.

2. Plant group A, discharging directly to streams will be required to meet pretreatment standards in 1977.

3. Plant groups B, C, D, and E discharging directly to streams will be required to meet BPT standards in 1977.

4. Plant groups A through E, discharging to municipal sewer systems will not be affected by BAT standards in 1983.

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*Pretreatment standards are assumed to be chemical treatment in which clarification of the effluents is not required.

5. Plant groups A and B, discharging directly to streams will be required to meet modified (water conservation) BAT standards in 1983.

6. Plant groups C, D, and E, discharging directly to streams will be required to meet BAT standards in 1983.

(b) Alternate B

Assumptions:

1. Plant group A, discharging to municipal sewer systems will be required to meet pretreatment satndards* in 1977.

2. Plant groups B, C, D, and E discharging to municipal sewer systems will be required to meet BPT standards in 1977.

3. Plant group A, discharging directly to streams will be required to meet pretreatment standards* in 1977.

4. Plant groups B, C, D, and E discharging directly to streams will be required to meet BPT standards in 1977.

5. Plant groups A through E discharging to municipal sewer systems will not be affected by BAT standards in 1983.

6. Plant groups A and B, discharging directly to streams will be required to meet modified (water conservation) BAT standards in 1983.

7. Plant groups C, D, and E discharging directly to streams will be required to meet BAT standards in 1983.

---

*Pretreatment standards are assumed to be chemical treatment in which clarification of the effluents is not required.

PRINCIPAL VARIABLES WHICH AFFECT PLANT CLOSURE RATES

(a) Price Increases

There is a very low ratio of current cash flow to the required pollution control investment (See Exhibits IV-2, IV-3, V-8 and V-12). Price increases which pass on pollution control costs are anticipated because the firm must raise its cash flow both to finance the investment and to achieve a competitive rate of return. All establishments will incur additional costs due to pollution control, and as long as the required price increase of the firm is similar to the increased market price, the competitive position of indifidual firms will not change. In Exhibits VI-5 and VI-6 the required price increase for each firm size category was calculated. Table VII-1 summarizes data for Alternates A and B in 1977.

Table VII-1

Price Increases - BPT - 1977

Plant Code	Alternate A Direct Dischargers Percent Increase	Alternate A Municipal Dischargers Percent Increase	Alternate B Municipal and Direct Dischargers Percent Increase
A	18.6%	18.4%	18.6%
B	15.5	7.8	15.5
C	16.0	8.0	16.0
D	15.2	7.6	15.2
E	15.0	7.5	15.0
Weighted Average	15.5	8.3	15.5

Source: Exhibits VI-5, VI-6

Smaller firms require price increases which are higher than the weighted average or market price increase which will be obtainable. Thus, the 1 to 4 man shops will be at a competitive disadvantage compared to remaining establishment size categories in the Electroplating Industry.

The price increases required by the model plant groups for direct discharging plants for 1983 are estimated as shown in the following table.

Table VII-2

Price Increases - BAT - 1983

Plant Code	Municipal Discharger Percent Increase	Direct Discharger Percent Increase
A	0 %	15.1%
B	0	6.1
C	0	9.5
D	0	8.0
E	0	7.7
Weighted Average	0	8.4

Source: Exhibits VI-10

As was noted in the discussion of price increases in Section VI for BPT - 1977, the very small plants will require a price increase approximately twice that of the industry average which it cannot obtain. Thus, the competitive and economic disadvantage of the small plants will continue through 1983.

In assessing the economic impact of BPT pollution abatement requirements for direct discharge plants, it is estimated that the small plants which remain after 1977 will survive principally because they compete in specialized markets, isolated locations, or are low cost producers. These plants will be able to get the necessary price increases to meet the cost of pollution control.

The present increases in prices for electroplating services have been projected to be similar for direct discharge plants in Alternate A and for all plants in Alternate B. However, for those establishments discharging to municipal treatment systems in Alternate A, the smallest group of establishments (Code A), have been projected to require increases approximately double those which will be required for the other, larger plants. Also, firms with greater than four employees which discharge to a municipal system in Alternate A have price increases which are half those of direct dischargers. It is evident that if Alternate A is adopted, firms discharging to municipal treatment systems, except for the smallest ones, will have a considerable competitive advantage if user charges are not larger than required price increases of the direct discharger.

Even if similar price increases due to pollution abatement requirements are experienced by all establishments in the industry, there may be impact on customer demand due to price increases. The alternatives open to customers are:

1. Pay price increases and continue to purchase electroplating services.

2. Seek firms which may offer electroplating services at lower costs.

3. Seek substitute methods of coating to replace electroplating.

4. Seek substitute materials to replace metals requiring electroplating; i.e., redesign the product.

5. Reduce the volume of plating required per unit of product.

Alternate methods of coating, and/or alternate materials may indeed replace electroplating in some cases. The results of industry surveys have indicated that substitution of materials will be relatively minor, partly because of existing customer preferences for electroplated surfaces and partly because price increases will also occur in substitute processes and areas which will tend to neutralize their apparent advantage.

Those firms which offer specialized services (such as deep plating tanks or engineering plating) will minimize the movement of their customers to another shop. Additionally, geographic locations which result in freight cost advantages may tend to offset price differences which may exist from one plant to another.

The net effect of these factors will be to minimize the impact of increases in prices as a factor in determining potential closures of plants. Where closures do occur, other factors such as poor past performance and inability to raise capital for pollution abatement will be more important than the ability to obtain the required price increase.

IMPACT OF CAPITAL REQUIREMENTS ON POTENTIAL PLANT CLOSURES

It is expected that the greatest factor bearing on plant closures is the inability of the very small plants to raise the necessary capital to purchase the pollution abatement equipment because the profitability of the small firms impacted is not maintained due to the inability to obtain an adequate price increase. Many very small firms under normal circumstances are unprofitable and undercapitalized and therefore pollution control will not cause their failures. The small firms with good sales often have low profitability and lack the borrowing capacity to meet pollution control costs and remain viable. Firms that have low sales with good profitability will not generate sufficient cash flow to purchase pollution control equipment. These are the firms that will be impacted by the requirements for water pollution controls.

Price increases used in the analysis of economic impact are a function of annualized costs as a percent of sales.

Investment cost estimates are presented in Exhibits V-5 through V-12 for each of the electroplating shop size groups for BPT, Alternates A and B, and for BAT. These costs, as a percent of sales, are summarized in Table VII-3 on the following page.

Table VII-3

BPT Investment Costs as a Percent of Annual Sales for Direct Dischargers and Municipal Dischargers

Plant Group	Average Sales $.000	ALTERNATE A				ALTERNATE B	
		Direct Dischargers Investment		Municipal Dischargers Investment		Direct Dischargers and Municipal Dischargers Investment	
		Per Plant	% of Sales	Per Plant	% of Sales	Per Plant	% of Sales
A	40.3	$ 25,000	62.0%	$ 25,000	62.0%	$ 25,000	62.0%
B	135.0	58,800	43.0	29,400	21.5	58,000	43.0
C	263.0	117,600	44.7	58,800	22.4	117,600	44.7
D	594.0	252,000	42.4	126,000	21.2	252,000	42.4
E	1,345.5	562,000	41.8	281,000	20.9	562,000	41.8
F	3,613.0	1.436,400	39.7	718,200	19.9	1,436,000	39.7

Source: Exhibits V-9 and V-10

Note that the small plants (Code A) are required to spend approximately 62% of their annual sales on pollution control while the larger plants will be required to spend approximately 39% to 45% of annual sales. This will obviously affect their ability to remain in operation to a considerably greater degree than for the larger plants. Amorization of costs for BPT will require 16.4% of annual sales for these small plants, while the requirements for the larger plants will generally be under 10% for the larger plants.

There is relatively little historical evidence available regarding the electroplating industry on which predictions of rates of plant closures can be based. Table VII-4 gives the data on establishments in SIC 3471, as reported in Census of Manufactures surveys for 1958 through 1972.

Table VII-4

Establishments and Employment - SIC 3471

Year:	1958	1963	1967	1972
Establishments:				
Over 20 Employees	542	677	855	795
Under 20 Employees	2,104	2,346	2,386	2,425
Total	2,646	3,023	3,241	3,220
Employment	36,500	45,000	55,100	53,300

Source: Census of Manufactures, 1958-1972

The industry has grown continuously except for a slight drop in 1972. Since decline in growth occurred prior to imposition of extensive pollution abatement requirements, the drop in establishments and employment in 1972 has been attributed to the downward trend in the business cycle which occurred between 1967 and 1972.

The estimates of closure rates were based on several judgemental factors which were evaluated during the study. These included responses to interviews of 62 plants, analysis of industry surveys made by NAMF, discussions with our consultants, and an analysis of the trends in use of electroplating services. Based on all of these factors, closure rates were estimated for the different size categories and for plants which were direct dischargers and municipal system dischargers for Alternates A and B. These closure rates for BPT by 1977 have been estimated, as shown in Table VII-5.

Table VII-5

Potential Closure Rate
1977

Model Plant Group	ALTERNATE A Percent Closures Direct Dischargers	 Municipal Dischargers	ALTERNATE B Percent Closures Direct and Municipal Dischargers
A	50% *	25.0%	50% *
B	25	12.5	25
C	10	5.0	10
D	3	1.5	3
E	3	1.5	3
F	0	0	0

Note: *See following paragraph for small plant exemption.

Source: A. T. Kearney Estimates

The small plant exemption (plants plating less than 33 square meters per hour) is designed to cover Plant Group A. Since this exemption reduces pollution control costs to that of the plant discharging to the municipal system, the estimated closure rate for this group in Alternates A and B for direct dischargers was reduced to 25 percent, or the same as for municipal dischargers in Alternate A.

The following table shows the number of independent electroplating plants which plate copper, nickel, chromium or zinc, which could be potentially impacted by the proposed effluent limitation standards. The plants are grouped according to level of sales and employment.

Table VII-6

Number of Independent Electroplating Plants Potentially Impacted by Proposed Effluent Limitation Standards

				Location of Plants	
Plant Code	Average Sales (000)	Number of Employees	Number Plants	Municipal Dischargers	Direct Dischargers
A	$ 40	1 - 4	924	711	213
B	135	5 - 9	426	328	98
C	263	10 - 19	433	333	100
D	595	20 - 49	463	357	106
E	1,346	50 - 99	128	99	29
			2,374	1,828	546

Source: Exhibits VII-1, VII-3

ESTIMATES OF PLANT CLOSURES

Exhibit VII-1 shows the number of municipal dischargers estimated to be closed if pretreatment standards are promulgated under Alternate A. 242 urban plants out of a total of 1,828, or 13.2 percent, have been estimated to potentially close.

Exhibit VII-2 shows the potential number of municipal dischargers estimated to be closed if BPT standards are promulgated for municipal dischargers under Alternate B. This exhibit shows that 307 plants out of a total of 1,828, or 16.8 percent, are potential closures.

Exhibit VII-3 shows the potential number of direct discharger plants estimated to be closed due to the BPT standards under Alternates A or B. This exhibits shows that 92 of a total of 546 plans, or 16.8 percent, are potential closures.

Exhibit VII-4 shows the total potential plants closures, both municipal and direct dischargers, for Alternate A. This is summarized in the following table.

Table VII-7

Alternate A
Summary of Total Potential Plant Closures

1977

Plant Code	Total Number of Plants	Potential Closures	
		Number	Percent
A	924	231	25.0%
B	426	66	15.5
C	433	27	5.2
D	463	8	1.7
E	128	2	1.6
	2,374	334	14.1%

Source: Exhibit VII-4

Exhibit VII-5 shows the total potential plant closures, both municipal and direct dischargers for Alternate B. This is summarized in the following table.

Table VII-8

Alternate B
Summary of Total Potential Plant Closures

1977

Plant Code	Total Number of Plants	Potential Closures	
		Number	Percent
A	924	231	25.0%
B	426	107	25.0
C	433	43	10.0
D	463	14	2.9
E	128	4	2.9
	2,374	399	16.8%

Source: Exhibit VII-5

It is important to emphasize that qualitatively based factors and other mitigating circumstances could alter these closure estimates. It is not possible to determine what each of these circumstances is. However, it is believed that the estimates developed here are of the correct order of magnitude.

It should be noted that of the 334 total potential plant closures for Alternate A, or 399 total potential plant closures for Alternate B, 242 in Alternate A are estimated to be the result of pretreatment standards which are not yet promulgated but are in the proposal stage.

Table VII-9

Alternate A
Summary of Plant Closures - 1977-1983

Type of Plant	BPT 1977		BAT 1983		Total	
	Number	Percent	Number	Percent	Number	Percent
Municipal	242	13.2%	-	-	242	13.2%
Direct Dischargers	92	16.8	24	5.3%	116	21.2
Total	334	14.1	24	5.3%	358	15.1

Source: Exhibits VII-2, 3, 4, 6, 7

Exhibit VII-8 summarizes the total number of estimated potential plant closures as a result of the proposed pretreatment BPT and BAT pollution abatement requirements for Alternate B. This exhibit indicates potential closures of 423 out of the 2,374 plants, or 17.8 percent.

The following table summarizes the estimated plant closures for Alternate B.

Table VII-10

Alternate B
Summary of Plant Closures - 1977-1983

	BPT 1977		BAT 1984		Total	
Area	Number	Percent	Number	Percent	Number	Percent
Municipal	307	16.8%	-	-	307	16.8%
Direct Dischargers	92	16.8	24	5.3%	116	21.2
Total	399	16.8%	24	5.3%	423	17.8%

Source: Exhibits VII-2,3,6,8

EMPLOYMENT EFFECTS

Since the majority of employees are in the large plant segment, most of the industry employees will not be adversely affected by the guidelines. Thus, high closure rate for the impacted smaller plants does not necessarily mean that the total unemployment rates will be the same as the total plant closure rates.

The total number of employees in the plant size groups used in this analysis is estimated to be 33,749. This number was arrived at by multiplying the average number of employees per firm by the number of firms in each group, for size groups A through E, or for all shops with under 100 employees.

(a) BPT - 1977

The estimated number of employees affected by the potential plant closures of establishments discharging to municipal treatment systems for Alternate A is shown in Exhibit VII-9. Approximately 1,100 employees, or 4.1 percent, of the total employment in this group are estimated to be displaced.

For Alternate B the estimated number of employees affected by the potential plant closures of establishments discharging to municipal treatment systems is shown in Exhibit VII-10. 7.2%, or 1,923 employees are estimated to be affected by the plant closures.

Exhibit VII-11 shows the estimated number of employees affected by potential closures of direct discharge plants for Alternates A and B. It is estimated that 8.3 percent, or 578 of the employees in establishments which direct discharge will be affected.

For Alternate A the total estimated number of employees affected by the potential plant closures is estimated to be 5.0 percent, or 1,676 employees (Exhibit VII-12).

For Alternate B, the total estimated number of employees affected by the potential plant closures for municipal and direct dischargers is estimated to be 7.4 percent, or 2,501 employees (Exhibit VII-13).

It should be noted that whereas the total potential plant closures for Alternate A (Exhibit VII-14), is estimated to be 14.1 percent for BPT, the estimated total number of employees affected is only 5.0 percent. For Alternate B the plant closure rate for BPT is 16.8 percent (Exhibit VII-5) as compared to the employee displacement rate of 7.4 percent.

(b) BAT - 1983

Exhibit VII-14 shows the estimated employees affected by BAT potential plant closures for direct dischargers for Alternates A or B. It is estimated that 148 out of 6,306 employees, or 2.3 percent, will be affected.

(c) Summary - 1977-1983

For Alternate A the estimated number of employees affected by potential closures due to pretreatment, BPT, and BAT is shown in Exhibit VII-15. This exhibit shows that a total of approximately 1,822 out of a total of 33,749 employees, or 5.4 percent, would be affected by potential plant closures.

For Alternate A the following table summarizes the estimated number of employees affected by potential plant closures due to pollution controls for 1977 and 1983.

Table VII-11

Alternate A
Summary of Estimated Number of
Employees Affected

Area	BPT 1977 Number	BPT 1977 Percent	BAT 1983 Number	BAT 1983 Percent	Total Number	Total Percent
Municipal Discharger	1,098	4.1%			1,098	4.1%
Direct Discharger	578	8.3	148	2.3%	726	10.4
Totals	1,676	5.0%	148	0.4%	1,824"	5.4%

Source: Exhibits VII-9, 11, 12, 15

For Alternate B the estimated number of employees affected by potential closures due to pretreatment, BPT and BAT pollution abatement is shown in Exhibit VII-16. This exhibit indicates that a total of approximately 3,103 out of a total of 33,749 employees, or 9.2 percent, would be affected by potential plant closures.

The following table summarizes for Alternate B the estimated number of employees affected by potential plant closures due to pollution controls for 1977 and 1983 levels.

Table VII-12

Alternate B
Summary of Estimated Number of
Employees Affected

Area	BPT 1977 Number	BPT 1977 Percent	BAT 1983 Number	BAT 1983 Percent	Total Number	Total Percent
Municipal Dischargers	1,923	7.2%			1,923	7.2%
Direct Dischargers	578	8.3	148	2.3%	726	11.5
Totals	2,501	7.4%	148	2.3%	2,649	7.8%

Source: Exhibits VII-10,11,13,14,16

COMMUNITY EFFECTS

Electroplating shops are generally not major employers in a community. Consequently, although a large number of shops and employers could be affected, it is not believed that a particular community will be severely impacted.

In our survey and in discussions with consultants and members of the Electroplating Industry, it was noted that there is at present, a shortage of experienced personnel in the Electroplating Industry. Since shops remaining will absorb the business of closed shops, increased production will occur and thus approximately 50 percent of the personnel affected by the potential plant closures will be re-employed. It is expected that the re-employment will probably occur primarily in the urban areas. It is estimated that the net effect will be that only 900 out of the estimated 1,800 employees for Alternate A, will be displaced. For Alternate B it is estimated that 1,325 out of the estimated 2,600 affected employees will not find re-employment in the Electroplating Industry.

PRODUCTION EFFECTS

(a) BPT - 1977

Exhibits VII-17, VII-19 and VII-20 show the production effects in estimated dollars of sales affected by potential closures of plants due to pretreatment and BPT standards under Alternate A. These are summarized on the following page.

Table VII-13

Alternate A
Estimated Dollar Sales Affected by Potential Plant Closures for Pretreatment and BPT Standards

	Estimated Volume	
	Dollars ($.000)	Percent
Municipal Dischargers	$21,494.7	4.3%
Direct Dischargers	11,268.3	7.5
Total	$32,763.0	5.0%

Source: Exhibits VII-17,19,20

Exhibits VII-18, VII-19 and VII-21 shows the estimated dollars of sales affected by potential closures of plants due to pretreatment and standards under Alternate B. These exhibits are summarized in Table VII-14.

Table VII-14

Alternate B
Estimated Dollar Sales Affected By Potential Plant Closures for Pretreatment and BAT Standards

	Estimated Volume	
Area	Dollars ($.000)	Percent
Municipal Dischargers	$37,492.9	7.4%
Direct Dischargers	11,268.3	7.5
Total	$48,761.8	7.4

Source: Exhibits VII-18,19,21

(c) BAT - 1983

Exhibit VII-22 shows the estimated production effects of potential closures of direct dischargers for BAT, Alternates A and B. This exhibit shows that aporoximately 2.1 percent, or $2.9 million of electroplating services could be affected by the guideline.

(c) Summary BPT and BAT

The estimated sales volume that will be effected by potential closures of plants in 1977 and 1983 for Alternates A and B, is shown in Exhibits VII-23 and VII-24. These are summarized in the following table.

Table VII-15

Alternates A & B

Total Estimated Dollar Sales Affected by Potential Plant Closures 1977-1983

Level	Alternate A		Alternate B	
	Dollars ($.000)	Percent	Dollars ($.000)	Percent
Pretreatment & BPT	$32,763.0	5.0%	$48,761.2	7.4%
BAT	2,899.2	2.1	2,899.2	2.1
Total	$35,662.2	5.5%	$51,660.4	7.9%

Source: Exhibits VII-23, VII-24

Several factors may offset the potential reduction in supply. The larger independent shops should be able to absorb a substantial portion of the demand. Captive shops may also be potential sources of supply. We believe the estimated reduced electroplating services will be shifted to, or absorbed by, the remaining plants in the industry.

EXHIBIT VII-1

ENVIRONMENTAL PROTECTION AGENCY

ALTERNATE A

NUMBER OF POTENTIAL CLOSURES OF MUNICIPAL DISCHARGERS FOR PRETREATMENT STANDARDS

Plant Code	Number of Employees	Number of Plants	Potential Closures		Remaining Plants	
			Number	Percent	Number	Percent
A	1 - 4	711	178	25.0%	533	75.0%
B	5 - 9	328	41	12.5	287	87.5
C	10 - 19	333	17	5.0	316	95.0
D	20 - 49	357	5	1.5	352	98.5
E	50 - 99	99	1	1.5	98	98.5
	Total	1,828	242	13.2%	1,586	86.5%

Source: A. T. Kearney, Inc.

ENVIRONMENTAL PROTECTION AGENCY

ALTERNATE B

NUMBER OF POTENTIAL CLOSURES OF MUNICIPAL DISCHARGERS FOR BPT*

Plant Code	Number of Employees	Number of Plants	Potential Closures		Remaining Plants	
			Number	Percent	Number	Percent
A	1 - 4	711	178	25.0%	533	75.0%
B	5 - 9	382	82	25.0	246	75.0
C	10 - 19	333	33	10.0	300	90.0
D	20 - 49	357	11	3.0	346	97.0
E	50 - 99	99	3	3.0	96	97.0
	Total	1,828	307	16.8%	1,521	83.2%

Note: *BPT for plant codes B, C, D, E; Pretreatment for plant code A.

Source: A. T. Kearney, Inc.

EXHIBIT VII-3

ENVIRONMENTAL PROTECTION AGENCY

ALTERNATE A OR B

NUMBER OF POTENTIAL CLOSURES OF DIRECT DISCHARGERS FOR BPT* POLLUTION ABATEMENT

Plant Code	Number of Employees	Number of Plants	Potential Closures		Remaining Plants	
			Number	Percent	Number	Percent
A	1 - 4	213	53	25.0%	160	75.0%
B	5 - 9	98	25	25.0	73	75.0
C	10 - 19	100	10	10.0	90	90.0
D	20 - 49	106	3	3.0	103	97.0
E	50 - 99	29	1	3.0	28	97.0
	Total	546	92	16.8%	454	83.2%

Note: *BPT for plant codes B, C, D and E. Pretreatment for plant code A.

Source: A. T. Kearney, Inc.

EXHIBIY VII-4

ENVIRONMENTAL PROTECTION AGENCY

ALTERNATE A

NUMBER OF POTENTIAL CLOSURES OF ALL PLANTS FOR BPT AND PRETREATMENT

Plant Code	Number of Employees	Number of Plants	Potential Closures		Remaining Plants	
			Number*	Percent	Number	Percent
A	1 - 4	924	231	25.0%	693	75.0%
B	5 - 9	426	66	15.5	360	84.5
C	10 - 19	433	27	6.2	406	93.8
D	20 - 49	463	8	1.7	455	98.3
E	50 - 99	128	2	1.6	126	98.4
	TOTAL	2,374	334	14.1%	2,040	85.9%

Note: *From Exhibit VII-1 and VII-3

Source: A. T. Kearney, Inc.

EXHIBIT VII-5

ENVIRONMENTAL PROTECTION AGENCY

ALTERNATE B

NUMBER OF POTENTIAL CLOSURES OF DIRECT AND MUNICIPAL DISCHARGERS FOR BPT POLLUTION ABATEMENT

Plant Code	Number of Employees	Number of Plants	Potential Closures		Remaining Plants	
			Number*	Percent	Number	Percent
A	1 - 4	924	231	25.0%	693	75.0%
B	5 - 9	426	107	25.0	319	75.0
C	10 - 19	433	43	10.0	390	90.0
D	20 - 49	463	14	2.9	449	97.1
E	50 - 99	128	4	2.9	124	97.1
	TOTAL	2,374	399	16.8%	1,975	83.2%

Note: *From Exhibits VII-2 and VII-3

Source: A. T. Kearney, Inc.

EXHIBIT VII-6

ENVIRONMENTAL PROTECTION AGENCY

ALTERNATE A OR B

NUMBER OF POTENTIAL CLOSURES OF DIRECT DISCHARGERS FOR BAT POLLUTION ABATEMENT

Plant Code	Number of Employees	Number of Plants (1)	Potential Closures Number	Potential Closures Percent	Remaining Plants Number	Remaining Plants Percent
A	1 - 4	160	16	10.0%	144	90.0%
B	5 - 5	73	4	5.0	69	95.0
C	10 - 19	90	2	2.0	88	98.0
D	20 - 49	103	2	2.0	101	98.0
E	50 - 99	28	-	2.0	28	98.0
	Total	454	24	5.3	430	94.7%

Note: (1) Plants remaining assuming potential closures occur in 1977.

Source: A. T. Kearney, Inc.

EXHIBIT VII-7

ENVIRONMENTAL PROTECTION AGENCY

ALTERNATE A

NUMBER OF POTENTIAL CLOSURES OF TOTAL PLANTS FOR BPT AND BAT POLLUTION ABATEMENT

Plant CODE	Number of Employees	Number of Plants	Potential Closures		Remaining Plants	
			Number	Percent	Number	Percent
A	1 - 4	924	247	26.8%	677	73.3%
B	5 - 9	426	70	16.4	356	83.6
C	10 - 19	433	29	6.7	404	93.3
D	20 - 49	463	10	2.2	453	97.8
E	50 - 99	128	2	1.6	126	98.4
Total		2,374	358	15.0	2,016	84.9%

Source: A. T. Kearney, Inc.

EXHIBIT VII-8

ENVIRONMENTAL PROTECTION AGENCY

ALTERNATE B

NUMBER OF POTENTIAL CLOSURES OF TOTAL PLANTS FOR BPT, PRETREATMENT AND BAT

Plant Code	Number of Employees	Number of Plants	Potential Closures		Remaining Plants	
			Number	Percent	Number	Percent
A	1 - 4	924	247	26.7%	677	73.3%
B	5 - 9	426	111	26.1	315	73.9
C	10 - 19	433	45	10.4	388	89.6
D	20 - 49	463	16	3.5	447	96.5
E	50 - 99	128	4	3.1	124	96.9
Total		2,374	423	17.8	1,951	82.2%

Source: A. T. Kearney, Inc.

EXHIBIT VII-9

ENVIRONMENTAL PROTECTION AGENCY

ALTERNATE A

ESTIMATED NUMBER OF EMPLOYEES AFFECTED BY POTENTIAL CLOSURES OF MUNICIPAL DISCHARGERS FOR BPT POLLUTION ABATEMENT

Plant Code	Number of Employees			Number of Potential Plant Closures*	Estimated Number of Employees Affected	
	Range	Average per Plant	All Plants		Number	Percent
A	1 - 4	2	1,482	178	356	24.0%
B	5 - 9	7	2,392	41	287	12.0
C	10 - 19	14	4,860	17	238	4.9
D	20 - 49	30	11,139	5	150	1.3
E	50 - 99	67	6,884	1	67	1.0
Total			26,757	242	1,098	4.1%

Note: *From Exhibit VII-1

Source: A. T. Kearney, Inc.

EXHIBIT VII-10

ENVIRONMENTAL PROTECTION AGENCY

ALTERNATE B

ESTIMATED NUMBER OF EMPLOYEES AFFECTED BY POTENTIAL CLOSURES OF MUNICIPAL DISCHARGERS FOR BPT POLLUTION ABATEMENT

Plant Code	Number of Employees			Number of Potential Plant Closures*	Estimated Number of Employees Affected	
	Range	Average per Plant	All Plants		Number	Percent
A	1 - 4	2	1,482	178	356	24.0%
B	5 - 9	7	2,392	82	574	24.0
C	10 - 19	14	4,860	33	462	9.5
D	20 - 49	30	11,139	11	330	3.0
E	50 - 99	67	6,884	3	201	2.9
Total			26,757	307	1,923	7.2%

Note: *From Exhibit VII-2

Source: A. T. Kearney, Inc.

EXHIBIT VII-11

ENVIRONMENTAL PROTECTION AGENCY

ALTERNATE A OR B

ESTIMATED NUMBER OF EMPLOYEES AFFECTED BY POTENTIAL CLOSURES FOR DIRECT DISCHARGERS FOR BPT POLLUTION ABATEMENT

Plant Code	Number of Employees			Number of Potential Plant Closures*	Estimated Number of Employees Affected	
	Range	Average per Plant	All Plants		Number	Percent
A	1 - 4	2	389	53	106	27.2%
B	5 - 9	7	625	25	175	28.0
C	10 - 19	14	1,270	10	140	11.0
D	20 - 49	30	2,926	3	90	4.0
E	50 - 99	67	1,782	1	67	3.8
Total			6,992	92	578	8.3%

Note: *From Exhibit VII-3

Source: A. T. Kearney, Inc.

EXHIBIT VII-12

ENVIRONMENTAL PROTECTION AGENCY

ALTERNATE A

ESTIMATED NUMBER OF EMPLOYEES AFFECTED BY POTENTIAL CLOSURES FOR DIRECT AND MUNICIPAL DISCHARGERS FOR BPT AND PRETREATMENT

Plant Code	Number of Employees			Number of Potential Plant Closures*	Estimated Number of Employees Affected	
	Range	Average per Plant	All Plants		Number	Percent
A	1 - 4	2	1,871	231	462	24.7%
B	5 - 9	7	3,017	66	462	15.3
C	10 - 19	14	6,130	27	378	6.2
D	20 - 49	30	14,065	8	240	1.7
E	50 - 99	67	8,666	2	134	1.5
Total			33,749	3,343	1,676	

Note: *From Exhibit VII-4

Source: A. T. Kearney, Inc.

EXHIBIT VII-13

ENVIRONMENTAL PROTECTION AGENCY

ALTERNATE B

ESTIMATED NUMBER OF EMPLOYEES AFFECTED BY POTENTIAL CLOSURES FOR DIRECT AND MUNICIPAL DISCHARGERS FOR BPT

Plant Code	Number of Employees			Number of Potential Plant Closures*	Estimated Number of Employees Affected	
	Range	Average per Plant	All Plants		Number	Percent
A	1 - 4	2	1,871	231	462	25.0%
B	5 - 9	7	3,017	107	749	24.8
C	10 - 19	14	6,130	43	602	9.8
D	20 - 49	30	14,065	14	420	3.0
E	50 - 99	67	8,666	4	268	3.1
Total			33,749	399	2,501	7.4%

Note: *From Exhibit VII-5

Source: A. T. Kearney, Inc.

EXHIBIT VII-14

ENVIRONMENTAL PROTECTION AGENCY

ALTERNATE A AND B

ESTIMATED NUMBER OF EMPLOYEES AFFECTED BY POTENTIAL CLOSURES FOR DIRECT DISCHARGERS FOR BAT

Plant Code	Number of Employees Range	Number of Employees Average per Plant	Number of Employees All Plants(1)	Number of Potential Plant Closures(2)	Estimated Number of Employees Affected Number	Estimated Number of Employees Affected Percent
A	1 - 4	2	174	16	32	18.3%
B	5 - 9	7	450	4	28	6.2
C	10 - 19	14	1,130	2	28	2.5
D	20 - 49	30	2,836	2	60	2.1
E	50 - 99	67	1,715	-	-	-
Total			6,306	24	148	2.3%

Notes: (1) Plants remaining after potential Level I closures.
(2) From Exhibit VII-6.

Source: A. T. Kearney, Inc.

EXHIBIT VII-15

ENVIRONMENTAL PROTECTION AGENCY

ALTERNATIVE A

ESTIMATED NUMBER OF EMPLOYEES AFFECTED BY POTENTIAL CLOSURES FOR ALL PLANTS FOR BPT, PRETREATMENT AND BAT

Plant Code	Number of Employees Range	Number of Employees Average Per Plant	Number of Employees All Plants	Number of Potential Plant Closures*	Estimated Number of Employees Affected Number	Estimated Number of Employees Affected Percent
A	1-4	2	1,871	247	494	26.4%
B	5-9	7	3,017	70	490	16.2
C	10-19	14	6,130	29	406	6.6
D	20-49	30	14,065	10	406	2.1
E	50-99	67	8,666	2	300	1.5
	Total		33,749	358	1,824	5.4%

*From Exhibit VII-7

Source: A. T. Kearney, Inc.

EXHIBIT VII-16

ENVIRONMENTAL PROTECTION AGENCY

ALTERNATIVE B

ESTIMATED NUMBER OF EMPLOYEES AFFECTED BY POTENTIAL CLOSURES FOR ALL PLANTS FOR BPT AND BAT

Plant Code	Number of Employees Range	Number of Employees Average Per Plant	Number of Employees All Plants	Number of Potential Plant Closures*	Estimated Number of Employees Affected Number	Estimated Number of Employees Affected Percent
A	1-4	2	1,871	247	494	26.4%
B	5-9	7	3,017	111	777	25.8
C	10-19	14	6,130	45	630	10.3
D	20-49	30	14,065	16	480	3.4
E	50-99	67	8,666	4	268	3.1
	Total		33,749	423	2,649	7.8%

*From Exhibit VII-8

Source: A. T. Kearney, Inc.

EXHIBIT VII-17

ENVIRONMENTAL PROTECTION AGENCY

ALTERNATE A

ESTIMATED DOLLAR SALES AFFECTED BY POTENTIAL CLOSURES FOR MUNICIPAL DISCHARGERS FOR PRETREATMENT STANDARDS

Plant Code	Number of Employees	Average Sales ($000) Average Per Plant	Average Sales ($000) All Plants	Number of Potential Plant Closures*	Estimated Sales Volume Affected ($000) Sales	Estimated Sales Volume Affected ($000) Percent
A	1-4	$ 40.3	$ 28,653.3	178	$ 7,173.4	25.0%
B	5-9	135.0	43,875.0	41	5,535.0	12.6
C	10-19	262.9	87,545.7	17	4,469.3	5.1
D	20-49	594.3	212,165.1	5	2,971.5	1.4
E	50-99	1,345.5	133,204.5	1	1,345.5	1.0
			$505,443.6	242	$21,494.5	4.3

*From Exhibit VII-1

Source: A. T.Kearney, Inc.

EXHIBIT VII-18

ENVIRONMENTAL PROTECTION AGENCY

ALTERNATE B

ESTIMATED DOLLAR SALES AFFECTED BY POTENTIAL CLOSURES FOR MUNICIPAL DISCHARGERS FOR BPT

Plant Code	Number of Employees	Average Sales ($000) Average Per Plant	Average Sales ($000) All Plants	Number of Potential Plant Closures*	Estimated Sales Volume Affected ($000) Sales	Estimated Sales Volume Affected ($000) Percent
A	1-4	$ 40.3	$ 28,653.3	178	7,173.4	25.0%
B	5-9	135.0	43.875.0	82	11,070.0	25.2
C	10-19	262.9	87,545.7	33	8,675.7	9.9
D	20-49	594.3	212,165.1	11	6,537.3	3.1
E	50-99	1,345.5	133,204.5	3	4,036.5	3.0
	Total		$505,443.6	307	$37,492.9	7.4%

*From Exhibit VII-2

Source: A. T. Kearney, Inc.

EXHIBIT VII-19

ENVIRONMENTAL PROTECTION AGENCY

ALTERNATE B

ESTIMATED DOLLAR SALES AFFECTED BY POTENTIAL CLOSURES FOR DIRECT DISCHARGERS FOR BPT

Plant Code	Number of Employees	Average Sales ($000) Average Per Plant	Average Sales ($000) All Plants	Number of Potential Closures*	Estimated Sales Volume Affected ($000) Sales	Estimated Sales Volume Affected ($000) Percent
A	1-4	$ 40.3	$ 8,583.9	53	$ 2,135.9	24.9%
B	5-9	135.0	13,230.0	25	3,375.0	25.5
C	10-19	262.9	26,290.0	10	2,629.0	10.0
D	20-49	594.3	62.995.8	3	1,782.9	2.8
E	50-99	1,345.5	39.019.5	1	1,345.5	3.4
			$150,119.2	92	11,268.3	7.5%

*From Exhibit VII-3

Source: A. T. Kearney, Inc.

EXHIBIT VII-20

VII-43

ENVIRONMENTAL PROTECTION AGENCY

ALTERNATE A

ESTIMATED DOLLAR SALES AFFECTED BY POTENTIAL CLOSURES FOR ALL PLANTS FOR BPT AND PRETREATMENT

Plant Code	Number of Employees	Average Sales ($000) Average Per Plant	Average Sales ($000) All Plants	Number of Potential Plants Closures*	Estimated Sales Volume Affected ($000) Sales	Estimated Sales Volume Affected ($000) Percent
A	1-4	40.3	$ 37,237.2	231	9,309.3	25.0%
B	5-9	135.0	57.510.0	66	8,910.0	15.5
C	10-19	262.9	113,835.7	27	7,098.3	6.2
D	20-49	594.3	275.160.9	8	4,754.4	1.7
E	50-99	1,345.5	172,224.0	2	2,691.0	1.6
			$655,967.8	334	$32,763.0	5.0%

*From Exhibit VII-4

Source: A. T. Kearney, Inc.

EXHIBIT VII-21

ENVIRONMENTAL PROTECTION AGENCY

ALTERNATE B

ESTIMATED DOLLAR SALES AFFECTED BY POTENTIAL CLOSURES FOR DIRECT DISCHARGERS AND MUNICIPAL DISCHARGERS FOR BPT POLLUTION ABATEMENT

Plant Code	Number of Employees	Average Sales ($000)		Number of Potential Plant Closures*	Estimated Sales Volume Affected ($000)	
		Average Per Plant	All Plants		Sales	Percent
A	1-4	40.3	$ 37.237.2	231	$ 9,309.3	25.0%
B	5-9	135.0	57,510.0	107	14,445.0	25.1
C	10-19	262.9	113,835.7	43	11,304.7	9.9
D	20-49	594.3	275.160.9	14	8,320.2	3.0
E	50-99	1,345.5	172,224,0	4	5,382.0	3.1
			$655,967.8	399	$48,761.2	7.4%

*From Exhibit VII-5

Source: A. T. Kearney, Inc.

EXHIBIT VII-22

ENVIRONMENTAL PROTECTION AGENCY

ALTERNATES A & B

ESTIMATED DOLLAR SALES AFFECTED BY POTENTIAL CLOSURES FOR DIRECT DISCHARGERS FOR BAT

Plant Code	Number of Employees	Average Sales ($000) Average Per Plant	Average Sales ($000) All Plants	Number of Potential Plant Closures*	Estimated Sales Volume Affected ($000) Sales	Estimated Sales Volume Affected ($000) Percent
A	1 - 4	$ 40.3	$ 4,271.8	16	$ 644.8	15.1%
B	5 - 9	135.0	9,855.0	4	540.0	5.5
C	10 - 19	262.9	23,661.0	2	525.8	2.2
D	20 - 49	594.3	61,212.9	2	1,188.6	1.9
E	50 - 99	1,345.5	27,674.0	-	-	-
	Total		$136,674.7	24	$2,899.2	.2.1%

Note: *From Exhibit VII-6

Source: A.T. Kearney, Inc.

EXHIBIT VII-23

ENVIRONMENTAL PROTECTION AGENCY

ALTERNATE A

ESTIMATED DOLLAR SALES AFFECTED BY POTENTIAL CLOSURES OF ALL PLANTS FOR BPT, PRETREATMENT, AND BAT

Plant Code	Number of Employees	Average Sales ($000) Average Per Plant	Average Sales ($000) All Plants	Number of Potential Plant Closures*	Estimated Sales Volume Affected ($000) Sales	Estimated Sales Volume Affected ($000) Percent
A	1 - 4	$ 40.3	$ 37,237.2	247	$ 9,954.1	26.6%
B	5 - 9	135.0	57,510.0	70	9,450.0	16.4
C	10 - 19	262.9	113,835.7	29	7,624.1	6.7
D	20 - 49	594.3	275,160.9	10	5,943.0	2.2
C	50 - 99	1,345.5	172,224.0	2	2,691.0	1.6
	Total		$665,967.8	357	$35,622.2	5.5%

Note: *From Exhibit VII-7

Source: A. T. Kearney, Inc.

EXHIBIT VII-24

ENVIRONMENTAL PROTECTION AGENCY

ALTERNATE B

ESTIMATED DOLLAR SALES AFFECTED BY POTENTIAL CLOSURES OF ALL PLANTS FOR BPT, PRETREATMENT, AND BAT

Plant Code	Number of Employees	Average Sales ($000) Average Per Plant	Average Sales ($000) All Plants	Number of Potential Plant Closures*	Estimated Sales Volume Affected ($000) Sales	Estimated Sales Volume Affected ($000) Percent
A	1 - 4	$ 40.3	$ 37,237.2	247	$ 9,954.1	26.7%
B	5 - 9	135.0	57,510.0	111	14,985.0	26.1
C	10 - 19	262.9	113,835.7	45	11,830.5	10.4
D	20 - 49	594.3	275,160.9	16	9,508.8	3.5
E	50 - 99	1,345.5	172,224.0	4	5,382.0	3.1
	Total		$655,967.8	423	$51,660.4	7.9%

Note: *From Exhibit VII-8

Source: A. T. Kearney, Inc.

VIII - LIMITS OF THE ANALYSIS

In this section the accuracy of the analysis and the major assumptions inherent in the conclusions are discussed.

ACCURACY

Accuracy of the economic impact analysis is directly dependent on the accuracy of information gathered pertaining to the electroplating industry. Specific sources of information which influence accuracy are the following:

1. Published United States Government data.
2. Published industry data.
3. Unpublished information supplied by knowledgeable industry personnel.
4. Cost data provided by EPA developed separately under contract by Battelle Columbus Laboratories.
5. Estimates by Kearney personnel.

(a) United States Government Published Data

The published data provided by the Census of Manufactures, 1967 and 1973 and the Annual Survey of Manufactures, 1971 and 1972 have been relied upon heavily to construct the description of the electroplating industry size and structure. Insofar as these data are inaccurate, Kearney's assessment of economic impact will correspondingly require modification. Kearney assumed that the split between direct and municipal dischargers obtained from the Bureau of Census applied equally to all process segments.

(b) Published Industry Data

1. Plant Size and Metal Finishing Process Segment Distribution. The Metal Working Guide - 1973 published by Iron Age Magazine was used to establish the size distribution of number of plants by metal finishing process segment and number of employees. This document does not cover plants which employ less than 20 personnel. Kearney assumed that the distribution of establishments by process segment for the plants with under 20 personnel approximated that of establishments with 20 personnel and over. Insofar as this distribution of the smaller establishments is different, the economic impact will be correspondingly different.

2. Financial Data. Little financial data are available for firms in the metal finishing industry except for the Annual Statement Studies published by Robert Morris Associates, the Business and Economic Evaluation of the Metal Finishing Industry published by the Bureau of Business Research, Graduate School of Business Administration, the University of Michigan and information furnished by the National Association of Metal Finishers. No reliable sources which specifically segregated financial data by process segment and firm size were uncovered during the course of this survey. Therefore, all financial data presented are estimates of industry averages based on information obtained from the sources presented above.

(c) Unpublished Information Supplied by Industry Personnel

Kearney conducted a survey in which 61 establishments in SIC 3471 were either personally contacted or interviewed by telephone. The purpose of this survey was to determine plant capacities, type of water pollution control facilities in existence, operating and cost data, and plans for future growth and development.

In addition, Kearney was given some data on a confidential basis regarding sales and profit margins by some electroplating firms.

Kearney also personally interviewed 13 banks in large cities to determine criteria for making loans to electroplating firms and the availability of funds for pollution control equipment.

These data have been treated on a confidential basis and are assumed to be accurate. However, not all respondents would, or could, supply the desired information. Thus, some data had to be estimated to provide a complete analysis.

(d) Cost Data

Battelle Columbus Laboratories were retained by EPA to provide technical and cost data for the proposed effluent guidelines. Kearney was provided the Battelle Columbus Laboratories data by EPA as the data base on which to assess economic impact.

The cost data was reviewed where possible. This review was limited, but the order of magnitude of costs associated with the pollution technologies recommended seemed to be in line with industry expectations. Insofar as the cost data furnished by EPA through its technical contractor Battelle Columbus Laboratories is changed, modified or inaccurate, the economic impact assessment will correspondingly require modification.

(e) Municipal User Charges

The relationship of municipal discharger costs to meet pollution control to those of direct discharger is critical to impact assessment. Insofar as change in municipal user charges for use of municipal systems are not consistent with the cost relationships assumed in 1977 Alternates A and B and 1983, the impact ananlysis must be modified to reflect these changes.

(f) Kearney Estimates

Some data were considered proprietary and not made available by industry sources. Therefore, it was occasionally necessary to make estimates. All areas where estimates are made are documented as such.

CRITICAL ASSUMPTIONS IN THE ANALYSIS

The assessment of the economic impact of the proposed effluent guidelines in the electroplating industry is based on a set of assumptions. These assumptions have a direct bearing on the results of the study. The following major assumptions have been made:

(a) Cost Associated with the Proposed Effluent Guidelines

All economic impact analysis is based only on the costs of meeting the proposed effluent guidelines provided by EPA through its technical contractor Battelle Columbus Laboratories. Treatment technology is only relevant as it relates to the costs imposed. Some industry members have questioned whether the proposed effluent guidelines can be achieved with the suggested technology. If the required technology changes and costs are revised due to technical innovations, or if costs are collectively modified through other arrangements such as industrial treatment districts, then the economic impact will be correspondingly altered.

(b) Ability of the Firms in the Industry to Meet the Proposed Effluent Guidelines

The economic impact analysis assumes that all viable firms in the industry which pass the closure analysis will be able to stay in business. The analysis assumes that the firms will be able to install pollution control equipment in time to meet the 1977 and 1983 deadlines and that financing will be available for those who qualify. If firms cannot meet the 1977 and 1983 deadlines due to inadequate lead time in the face of tight supply conditions in pollution control equipment and/or if tight money makes funds unavailable for pollution control equipment, then the impact will be correspondingly more severe.

(c) Regulatory Enforcement

It was assumed that the enforcement of the effluent guideline regulations for both direct dischargers by the federal government and municipal dischargers by local authorities will be effective and establishments will not be able to operate in violation of guidelines.

(d) Response to Guidelines

It was assumed that industry will respond to the effluent guideline limitations as promulgated. If industry response is based on a belief that guidelines will be changed or delayed by administrative or legal action, impact will change correspondingly. Potentially delays in responding could create much more severe impacts.

CRITICAL PARAMETER ESTIMATES

Based on the information available, estimates have been made of economic parameters necessary to the impact analysis. Insofar as these estimates do not accurately reflect real conditions, the impact results may require modification.

(a) Plant Size Characteristics

It was assumed that plants within each industry size segment have similar characteristics. Sales and employment are assumed to be relevant units of industry categorization for the economic impact analysis. Within each size and process segment the "average" or "typical" plant is considered representative of the impact of all plants in that group.

(b) Operating Characteristics in the Industry

The assumption was made that the distinctions made by Battelle Columbus Laboratories adequately reflected differences between small plants and large plants with respect to waste streams and the method of performance of metal finishing operations.

(c) Volume of Water Discharged

In the absence of more accurate data, the volume of water discharged into streams versus that discharged into municipal sewers was assumed to be representative, regardless of the location of the plants.

(d) Plant Distribution by Geographical Location

The municipal dischargers and direct dischargers were assumed to be distributed equally by geographical location. Also, it was assumed municipal and direct dischargers occurred in the proportion in urban and rural communities, that is, 77% and 23%, respectively.

(e) Current Investment in Pollution Control

The plants in the industry which are affected by pollution abatement have either zero current investment in waste water treatment equipment, or the estimated costs to meet guidelines are in addition to present costs for those plants already using some type of treatment.

(f) Profitability of Firms

Profitability and costs for the direct dischargers and municipal dischargers were assumed to be similar.

(g) Investment and Profit Maximizing Decision

It was assumed that all shop owners will attempt to maximize profits. It was also assumed that five years profits would be the maximum amount of investment a shop owner would be willing to forego before going out of business.

APPENDIX A

DISCUSSION OF POLLUTION CONTROL FOR IN-PLANT OR CAPTIVE ELECTROPLATING OPERATIONS

IDENTIFICATION OF IN-PLANT OR CAPTIVE ELECTROPLATING OPERATIONS

Discussion in Section III of this report distinguished between the separate electroplating establishments covered by SIC 3471 and the in-plant or captive operations which are covered by the numerous SIC industrial groups which manufacture products for which electroplating services are required. Since the SIC method of classifying manufacturing establishments lists the establishments under the principal product or service listing which they furnish, other products or services which are considered to be secondary are not covered by SIC identification. Thus an electroplating establishments which is a separate entity, and which lists the electroplating service as its principal product, is listed under SIC 3471, regardless of whether the establishment is independently owned and operated, or is owned by another company and operated for its use. Conversely, a plant which produces a particular product such as automobiles and which includes in its operations an electroplating line, is listed under SIC 3711 covering automobiles, and the electroplating operation is considered to be completely captive or in-plant, and is not listed separately.

The purpose of this Appendix is to identify and discuss the in-plant or captive electroplating operations which were not included in the study.

OPERATIONS COVERED

In-plant operations which supplement the manufacturing processes in typical metalworking plants include almost every type of electroplating service. Although all of these do not exist in any single plant, and in fact plants generally only have one type of plating operation. Few, if any, of the metalworking plants which produce a finished product have an electroplating line installed as part of the manufacturing process.

NATURE OF ELECTROPLATING INSTALLATIONS

In-plant electroplating lines are almost always found in separate departments. Electroplating operations are considered to be service operations. Since there is no end product, other than the service performed, the electroplating operations are not generally considered to be profit centers. True costs in these departments are often not known since only the direct labor and direct materials costs can actually be isolated. In these circumstances, profitability in the usual sense is not measured, and only direct manufacturing costs are able to be identified.

SIZE OF IN-PLANT OR CAPTIVE ELECTROPLATING SEGMENT OF THE METAL PROCESSING INDUSTRIES

Because of the captive nature of the in-plant electroplating operations, very little reporting of these installations has been done, either to the Department of Commerce, or to the trade associations. Typically the companies which have in-plant electroplating operations are not members of the National Association of Metal Finishers or any of the other trade associations which represent the industry.

The principal source of information which is readily available regarding these in-plant operations comes from the 1967 Census of Manufactures report on selected metal working operations. The questionnaire for this report was sent only to establishments with more than ten total employees. Therefore, the small industrial establishments with less than ten employees provided no information regarding in-plant metal finishing operations.

Exhibits A-1, A-2, and A-3 were prepared from the data reported in the 1967 Census of Manufactures regarding the analysis of selected metalworking operations. These exhibits provide data on the number of establishments and number of in-plant metal finishing workers for 117 SIC groups. The following metal finishing operations were reported in the census data, and are covered by the exhibits.

Exhibit A-1	-	Electroplating and Other Plating
Exhibit A-2	-	Hot Dip Galvanizing and Other* Hot Dip Coating
Exhibit A-3	-	Painting, Lacquering and Enameling*

No information is available from census data regarding other metal finishing operations, such as polishing and buffing which may be located in the plants of the industry groups studied. These other operations probably are utilized to the same extent as the three primary groups reported. Additionally, no information is available from census sources regarding existence of metal finishing operations in other industry groups.

Exhibit A-4 summarizes the data for the industry and also provides data regarding the total employment and number of establishments. A total of 84,214 establishments with 7,779,600 employees were included in the SIC industry groups covered by the census report. Of these, 44,611 establishments with 7,671,400 employees had more than ten employees and were included in the analysis of metal working operations. These establishments were part of the following basic SIC industry groups:

SIC No.	Industry
19	Ordnance and Accessories
33	Primary Metal Industries
34	Fabricated Metal Products
35	Machinery Except Electrical
36	Electrical Equipment and Supplies
37	Transportation Equipment
38	Instruments and Related Products

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* These processes are not included in this study, but data is presented to provide an overview of all in-plant metal finishing operations.

From the data in Exhibits A-1, A-2, and A-3, the following information can be summarized regarding the number of in-plant metal finishing installations which have been reported.

Table A-1

Number of In-Plant Metal Finishing Installations

	Electroplating	Galvanizing*	Painting*
Establishments:			
1 - 4 Workers	1,107	231	7,931
5 - 19 Workers	704	101	1,974
Over 20 Workers	356	62	875
Totals	2,389	394	10,780
Production Workers			
1 - 4 Workers	2,085	268	12,845
5 - 19 Workers	5,529	441	14,386
Over 20 Workers	15,692	1,679	58,402
Totals	25,474	4,233	91,024

Note: * These processes are not included in this study, but data is presented to provide an overview of all in-plant metal finishing operations.

Source: Exhibit A-1, A-2 and A-3

From Exhibit A-4 the total number of establishments which were covered by the census data were:

	All Establishments	Establishments Over 10 Employees
Number of Establishments	84,214	44,611
Number of Employees	7,779,600	7,641,400

From the table note that:

1. Electroplating is utilized in 5.3% of the establishments reporting but only 0.3% of the total establishment employment participate in this activity.

2. Galvanizing is utilized in 0.8% of the establishments reporting and requires only .05% of total employment.

3. Painting is the most common finishing operation since 24.1% of the establishments indicated such in-plant facilities. Thus 1.2% of the total production employment is engaged in painting activities.

4. Only 52.9% of the total establishments have over 10 employees and reported. However, these establishments represent 98.2% of the industry employment.

5. Approximately 40,000 establishments were not included in the survey because they had fewer than ten employees per firm, only 138,000 employees were estimated to be employed in these establishments, or an average of 3.5 employees per establishment. The 44,611 establishments which were included in the survey had an average of 171 employees per firm.

The establishment totals of Table A-1 may not be cumulative because some plants may have more than one type of metal finishing operation installed. However, the production workers in these three process groups can be totaled, and add up to 120,731 workers. This is only 1.6 percent of the total employment in the industry, and averages only about nine workers per establishment for each process. Average metal finishing employment per plant represents only about 5 percent of total average employment per plant for the reporting firms.

Although no data based on actual industry surveys exist regarding the true number of establishments with in-plant metal finishing operations, there is good reason to believe that the total is actually far greater than the number reported in the census survey. Almost every establishment which manufactures a finished product or component has some form of metal finishing operations as part of its production facilities. Electroplating and galvanizing installations are relatively few in number and the numbers reported in the census reports may be representative of the actual totals. However, we believe that painting installations and other types of metal finishing operations which were not reported, may be up to 50 percent of the plants employing over ten people. If this is true, probably 22,000 establishments have one or more metal finishing operations installed. At an average of nine production workers per plant, the employment in the in-plant or captive metal finishing operations may be on the order of 200,000 workers.

NATURE OF THE POLLUTION PROBLEM

The water pollution problem related to in-plant electroplating operations is complicated by the fact that usually other operations which produce water pollution also exist in the plant. Cutting oils, solutions from washing and cleaning operations, coolants from welding and forming operations, wash water from air pollution wet scrubbers, and a variety of other liquid wastes are also generated. In the majority of cases the wastes from these operations combine with the wastes from metal finishing operations to form single waste streams.

RELATIONSHIP OF COSTS IN IN-PLANT OPERATIONS

The wide range of processes and products of the electroplating industry make it impossible to establish a direct relationship, based on reported information, between electroplating costs and total product costs.

As a means of approximating the overall relationship of electroplating costs to product costs, the Census of Manufactures data was used. For the seven industry groups which have been described as being included in the metal working industry, the value added by manufacture was almost exactly 50 percent of the value of shipments. The labor content of manufacturing is included in the value added, and in fact, constitutes about one-third of this item.

The production labor for electroplating operations has been identified as being 5 percent of the total labor for the establishments which were covered by the industry survey of selected metalworking operations. Assuming that the relationship of labor for electroplating operations is the same as it is for all manufacturing operations, then the value of electroplating can be calculated to be 5 percent of 50 percent of value of shipments, or about 2.5 percent of value of shipments. This will obviously vary widely depending on the nature of the final product and the amount of electroplating which is done. However, for purposes of overall analysis, electroplating costs can be taken at an average of $2.50 per $100 value of product.

Costs of pollution control may be less for in-plant electroplating operations than for separate establishments doing electroplating. This may be the case, since many studies have indicated larger treatment systems have lower costs even though they may treat diverse waste flows. Most of these in-plant installations will be in plants with significant additional waste generating processes. Although it can be assumed that direct labor and direct material costs may be about the same for both types of establishments, the overhead costs will be greatly different. This is because the costs of such items as maintenance, utilities, supervision and supplies are spread over a much larger production base in the integrated plant. Finally, in integrated plants compatible costs of pollution control are proportionately lower for only the electroplating portion because of the inherent economies present when treating the combined waste stream.

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ENVIRONMENTAL PROTECTION AGENCY

STUDY OF ECONOMIC IMPACT OF POLLUTION ABATEMENT ON ELECTROPLATING INDUSTRY

ELECTROPLATING AND OTHER PLATING OPERATIONS IN METALWORKING OPERATIONS

		Number of Establishments				Employment			
		Electroplating and Metal Finishing							
			Number of Production Workers				Number of Production Workers		
SIC Code	Industry	Number of Establishments	1 to 4	5 to 19	20 or More	Electroplating Employees	1 to 4	5 to 19	20 or More
1925	Complete Guided Missiles	12	-	6	6	417	-	62	355
1929	Ammunition	11	7	3	1	78	18	A	A
1931	Tanks and Tank Components	4	1	3	-	A	A	A	
1951	Small Arms	7	4	2	1	86	12	A	A
1961	Small Arms Ammunition	4	1	2	1	53	A	A	A
1999	Guns, Howitzers and Ordnance Access.	9	5	3	1	82	10	A	A
3421	Cutlery	15	9	4	2	112	28	A	A
3423	Hand and Edge Tools	57	32	21	4	357	55	188	114
3425	Hand Saws and Saw Blades	8	6	2		31	A	A	-
3429	Hardware	137	45	56	36	3,120	109	510	2,501
3431	Metal Sanitary Ware	4	1	1	2	A	A	A	A
3432	Plumbing Fittings and Brass Goods	39	12	13	14	681	30	143	508
3433	Heating Equipment	7	3	3	1	52	5	A	A
3441	Fabricated Structural Steel	3	1	1	1	29	A	A	A
3442	Metal Doors, Sash and Trim	20	5	7	8	511	14	58	439
3443	Fabricated Plate Shop - Boiler Shops	7	7	-	-	9	9		
3444	Sheet Metalwork	12	9	3		30	13	17	
3446	Architectural Metalwork	3	3			5	5		
3449	Miscellaneous Metalwork	3	2		1	A	A		A
3451	Screw Machine Products	20	16	4		74	33	41	
3452	Bolts, Nuts, Rivets and Washers	84	44	28	12	856	83	256	507
3461	Metal Stampings	119	61	37	21	1,230	109	322	799
3492	Safes and Vaults	2		2		A		A	
3493	Steel Springs	2	2			A	A	-	-
3494	Valves and Pipe Fittings	34	24	9	1	163	47	A	A
3498	Fabricated Pipe and Fitting	11	8	2	1	93	A	A	A
3499	Fabricated Metal Products	42	25	10	1	194	40	A	A
3511	Steam Engines and Turbines	2	1	1		A	A	A	
3519	Internal Combustion Engine	14	6	4	4	253	16	40	197
3542	Machine Tools	5	5			11	A		
3544	Special Dies, Tools, Jigs and Fixtures	29	21	7	1	139	39	A	A
3545	Machine Tool Accessories	32	22	10		115	23	92	
3548	Metal Working Machinery	16	11	5		66	19	47	
3553	Woodworking Machinery	10	3	4	3	129	4	32	93
3559	Special Industry Machinery	23	15	8		114	26	88	
3562	Ball & Roller Bearing	11	4	6	1	69	5	A	A
3564	Blowers and Fans	4	3	1		17	A	A	
3566	Power Transmission Equipment	16	13	1	2	82	25	A	A
3569	General Industry	10	7	2	1	44	13	A	A
3572	Typewriters	7	-	3	4	279	-	36	243
3573	Electronic Computing Equipment	25	8	12	5	372	19	148	205
3574	Calculating and Accounting Machinery	11	1	7	3	416	A	A	A
3576	Scales and Balances	1		1		A	A	A	A

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STUDY OF ECONOMIC IMPACT OF POLLUTION ABATEMENT ON ELECTROPLATING INDUSTRY

ELECTROPLATING AND OTHER PLATING OPERATIONS IN METALWORKING OPERATIONS

SIC Code	Industry	Number of Establishments – Electroplating and Other Plating: Number of Establishments	Number of Production Workers: 1 to 4	5 to 19	20 or More	Employment: Electroplating Employees	Number of Production Workers: 1 to 4	5 to 19	20 or More
3579	Office Machines	9	2	6	1	123	A	A	A
3581	Automatic Merchandising Machines	8	6	2		34	A	A	
3582	Commercial Laundry Equipment	5	4	1		14	A	A	A
3585	Refrigeration Machinery	14	7	7		81	14	67	
3589	Service Industry Machines	7	7			16	16		
3599	Miscellaneous Machinery	107	73	27	7	592	122	218	232
3611	Electric Measuring Equipment	37	21	11	5	286	39	85	162
3613	Switch Gear and Switchboard Apparatus	80	52	22	6	583	102	224	257
3621	Motors and Generators	29	20	9		132	39	93	
3622	Industrial Controls	17	6	6	5	262	10	54	198
3631	Household Cooking Equipment	8	4	2	2	106	11	A	A
3132	Household Refrigerators and Freezers	3			3	106			106
3633	Household Laundry Equipment	6	1	3	2	111	A	A	A
3634	Electric Housewares and Fans	36	12	12	12	607	28	133	446
3635	Household Vacuum Cleaners	4			4	105	-	-	105
3636	Sewing Machines	5	3	2		A	A	A	A
3639	Household Appliances	2	1		1	A	A		A
3642	Lighting Fixtures	75	35	30	10	754	62	282	410
3643	Current Carrying Wiring Devices	40	21	13	6	431	141	133	257
3644	Non-Current Carrying Wiring Devices	13	6	4	3	178	17	55	106
3651	Radio and TV Receiving Sets	14	7	5	2	277	17	D	D
3661	Telephone and Telegraph Apparatus	25	5	8	12	615	11	73	531
3662	Radio and TV Communication Equipment	114	51	38	25	1,583	92	360	1,131
3671	Electron Tubes Receiving Set	3		2	1	A		A	A
3672	Cathode Ray Picture Tubes	2	1	1		A	A	A	
3673	Electron Tubes, Transmitting	14	7	6	1	109	21	A	A
3674	Semi Conductors	38	18	15	5	428	39	152	237
3679	Electronic Components	184	107	56	21	1,611	201	540	1,070
3694	Engine Electrical Equipment	24	11	10	3	242	23	93	126
3711	Motor Vehicles	10	3	4	3	A	A	39	A
3713	Truck and Bus Bodies	1	1			A	A		
3714	Motor Vehicles Parts and Accessories	98	40	32	26	1,699	78	288	1,333
3721	Aircraft	23	6	9	8	760	10	96	654
3722	Aircraft Engines and Engine Parts	37	17	7	13	1,353	38	59	1,256
3729	Aircraft Equipment NEC	73	35	23	15	759	70	201	488
3751	Motorcycles, Bicycles and Parts	9	1	5	3	300	A	A	256
3791	Trailer Coaches	1	1	A	A	A	A		
3799	Transportation Equipment	4	2	1	1	A	4	A	A
3811	Engineering and Scientific Instruments	22	20	2	-	58	A	A	
3821	Mechanical Measuring Devices	35	23	7	5	290	36	69	185
3822	Automatic Temperature Controls	17	7	8	2	163	18	A	A
3871	Watches and Clocks	17	5	8	4	276	7	84	185
3872	Watchcases	12	6	6	-	61	10	51	-
		2,389	1,107	704	356	25,474	2,085	5,529	15,692

Note: A - Not Available - Information suppressed to protect specific plants in survey.

Source: 1967 Census of Manufactures

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A-12

ENVIRONMENTAL PROTECTION AGENCY

STUDY OF ECONOMIC IMPACT OF POLLUTION ABATEMENT ON THE ELECTROPLATING INDUSTRY

GALVANIZING AND OTHER HOT DIP COATING OPERATIONS IN METALWORKING INDUSTRY

SIC Code	Industry	Total Establishments	Number of Establishments: Number of Production Workers 1-4	Number of Establishments: Number of Production Workers 5-19	Number of Establishments: Number of Production Workers 20 or More	Employment: Total Employees	Employment: Number of Production Workers 1-4	Employment: Number of Production Workers 5-19	Employment: Number of Production Workers 20 or More
1925	Complete Guided Missiles	3	-	1	2	103	-	A	A
1929	Ammunition	6	1	5	-	53	A	A	-
1931	Tanks and Tank Components	2	-	2	-	A	-	A	-
1951	Small Arms	4	3	-	1	A	A	-	A
1999	Guns, Howitzers and Ordnance Access.	4	3	-	1	27	A	-	A
3429	Hardware	10	5	4	1	156	13	A	A
3433	Heating Equipment	1	1	-	-	A	A	-	-
3441	Fabricated Structural Steel	15	2	3	10	428	A	A	396
3442	Metal Doors, Sash and Trim	1	1	-	-	A	A	-	-
3443	Fabricated Plate Shop-Boiler Shops	10	6	2	2	106	17	A	A
3444	Sheet Metalwork	27	21	6	-	85	43	42	-
3446	Architectural Metalwork	2	1	1	-	A	A	A	-
3449	Miscellaneous Metalwork	2	2	-	-	A	A	-	-
3451	Screw Machine Products	4	4	-	-	6	6	-	-
3452	Bolts, Nuts, Rivets and Washers	16	7	9	-	82	12	70	-
3461	Metal Stampings	24	10	8	6	282	18	59	205
3481	Miscellaneous Fabricated Wire Products	31	21	7	3	173	42	51	80
3491	Metal Barrels, Drums, and Pails	1	-	1	-	A	-	A	-
3494	Valves and Pipe Fittings	17	7	6	4	176	14	59	103
3498	Fabricated Pipe and Fittings	8	3	5	-	38	7	31	-
3499	Fabricated Metal Products	8	6	2	-	32	A	A	-
3559	Special Industry Machinery	8	8	-	-	12	12	-	-
3561	Pumps and Compressors	8	7	-	1	32	A	-	A
3564	Blowers and Fans	2	1	1	-	A	A	A	-
3566	Power Transmission Equipment	1	1	-	-	A	A	-	-
3569	General Industry Machinery	4	4	-	-	7	7	-	-
3573	Electronic Computing Equipment	2	2	-	-	A	A	-	-
3582	Commercial Laundry Equipment	1	1	-	-	A	A	-	-
3585	Refrigeration Machinery	8	7	-	1	116	A	-	A
3586	Measuring and Dispensing Pumps	2	1	1	-	A	A	A	-
3589	Service Industry Machines	4	4	-	-	8	8	-	-
3621	Motors and Generators	5	1	3	1	59	A	A	A
3632	Household Refrigerators and Freezers	1	1	-	-	A	A	-	-
3633	Household Laundry Equipment	1	-	1	-	A	-	A	-
3634	Electric Housewares and Fans	1	1	-	-	A	A	-	-
3639	Household Appliances	1	-	1	-	A	-	A	-
3642	Lighting Fixtures	5	4	1	-	15	A	A	-
3643	Current Carrying Wiring Devices	8	5	3	-	31	8	23	-
3644	Noncurrent Carrying Wiring Devices	19	3	5	11	727	7	39	681
3651	Radio and TV Receiving Sets	2	2	-	-	A	A	-	-
3661	Telephone and Telegraph Apparatus	3	2	-	1	A	A	-	A

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STUDY OF ECONOMIC IMPACT OF POLLUTION ABATEMENT ON
THE ELECTROPLATING INDUSTRT
GALVANIZING AND OTHER HOT DIP COATING OPERATIONS IN METALWORKING INDUSTRY

SIC Code	Industry	Total Establishments	Number of Establishments Number of Production Workers 1-4	 5-19	 20 or More	Employment Total Employees	Employment Number of Production Workers 1-4	 5-19	 20 or More
3662	Radio and TV Communication Equipment	24	17	3	4	281	29	38	214
3673	Electron Tubes, Transmitting	2	2	-	-	A	A	-	-
3674	Semiconductors	2	1	1	-	A	A	A	-
3679	Electronic Components	31	29	2	-	64	A	A	-
3694	Engine Electrical Equipment	6	3	3	-	33	4	29	-
3711	Motor Vehicles	2	-	1	1	A	-	A	A
3713	Truck and Bus Bodies	3	1	1	1	A	A	A	A
3714	Motor Vehicle Parts and Accessories	20	10	7	3	680	16	A	A
3715	Truck Trailers	1	-	1	-	A	-	A	-
3721	Aircraft	8	1	1	6	354	A	A	A
3722	Aircraft Engines and Engine Parts	6	4	1	1	A	A	A	A
3729	Aircraft Equipment NEC	6	3	2	1	67	5	A	A
3791	Trailer Coaches	1	1	-	-	A	A	-	-
		394	231	101	62	4,233	268	441	1,679

Note: A - Not Available - Information suppressed to protect specific plants in survey.

ENVIRONMENTAL PROTECTION AGENCY

STUDY OF ECONOMIC IMPACT OF POLLUTION ABATEMENT ON
THE ELECTROPLATING INDUSTRY

PAINTING, LACQUERING AND ENAMELING ON METALS OPERATIONS IN METALWORKING INDUSTRY

			Number of Establishments			Employment			
			Number of Production Workers				Number of Production Workers		
SIC Code	Industry	Total Establishments	1-4	5-19	20 or More	Total Employees	1-4	5-19	20 or More
1925	Complete Guided Missiles	20	7	6	7	372	19	60	293
1929	Ammunition	36	12	10	14	805	17	106	682
1931	Tanks and Tank Components	10	4	1	5	201	A	A	185
1951	Small Arms	10	5	5	-	53	8	45	-
1961	Small Arms Ammunition	2	-	1	1	A	-	A	A
1999	Guns, Howitzers and Ordnance Access.	20	16	3	1	80	30	A	A
3411	Metal Cans	102	14	35	53	3,479	36	337	3,106
3421	Cutlery	16	14	2	-	43	A	A	-
3423	Hand and Edge Tools	115	91	22	2	408	154	A	A
3425	Handsaws and Saw Blades	20	15	4	1	83	26	A	A
3429	Hardware	238	168	50	20	2,058	274	439	1,345
3431	Metal Sanitary Ware	20	6	3	11	1,329	10	23	1,296
3432	Plumbing Fittings and Brass Goods	12	9	3	-	37	14	23	-
3433	Heating Equipment	169	113	39	17	1,046	190	331	525
3441	Fabricated Structural Steel	511	412	80	19	1,930	644	682	604
3442	Metal Doors,Sash and Trim	153	112	34	7	696	193	295	208
3443	Fabricated Platework-Boiler Shops	357	303	42	12	1,281	521	344	416
3444	Sheet Metalwork	291	230	50	11	1,127	389	436	302
3446	Architectural Metalwork	169	139	26	4	550	207	199	144
3449	Miscellaneous Metalwork	82	51	23	8	573	103	176	294
3451	Screw Machine Products	20	19	1	-	36	A	A	-
3452	Bolts, Nuts, Rivets and Washers	26	22	2	2	95	33	A	A
3461	Metal Stampings	385	206	101	78	5,986	396	910	4,680
3481	Miscellaneous Fabricated Wire Products	236	208	24	4	732	328	220	184
3491	Metal Barrels, Drums and Pails	91	47	31	13	905	104	289	512
3492	Safes and Vaults	15	12	1	2	110	A	A	A
3493	Steel Springs	37	29	8	-	112	49	63	-
3494	Valves and Pipe Fittings	133	116	14	3	402	222	98	82
3496	Collapsible Tubes	13	-	3	10	915	-	44	871
3497	Metal, Foil and Leaf	1	-	1	-	A	-	A	-
3498	Fabricated Pipe and Fittings	44	40	4	-	103	71	32	-
3499	Fabricated Metal Products	219	171	39	9	964	281	305	378
3511	Steam Engines and Turbines	14	9	2	3	134	18	A	A
3519	Internal Combustion Engines	55	30	15	10	538	54	128	356
3522	Farm Machinery	567	433	96	38	3,319	727	844	1,748
3531	Construction Machinery	260	177	65	18	1,757	321	619	817
3532	Mining Machinery	62	47	14	1	231	66	A	A
3533	Oilfield Machinery	99	82	15	2	313	150	A	A
3534	Elevators and Moving Stairways	48	38	8	2	236	72	A	A
3535	Conveyors and Conveying Equipment	157	141	16	-	334	226	108	-

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STUDY OF ECONOMIC IMPACT OF POLLUTION ABATEMENT ON
THE ELECTROPLATING INDUSTRY
PAINTING, LACQUERING AND ENAMELING ON METALS OPERATIONS IN METALWORKING INDUSTRY

SIC Code	Industry	Total Establishments	Number of Establishments: Number of Production Workers 1-4	5-19	20 or More	Employment: Total Employees	Employment: Number of Production Workers 1-4	5-19	20 or More
3536	Hoists, Cranes and Monorails	51	43	6	2	197	64	A	A
3537	Industrial Trucks and Tractors	108	89	15	4	358	142	119	97
3541	Machine Tools, Metal-Cutting Types	142	89	43	10	871	151	397	323
3542	Machine Tools, Metal-Forming Types	70	60	10	-	172	84	88	-
3544	Special Dies, Tools, Jigs and Fixtures	91	88	3	-	121	103	18	-
3545	Machine Tools Accessories	58	52	5	1	148	92	A	A
3548	Metalworking Machinery	79	65	12	2	274	97	A	A
3551	Food Products Machinery	181	162	16	3	436	240	128	68
3552	Textile Machinery	84	64	14	6	363	86	116	161
3553	Woodworking Machinery	69	62	4	3	224	91	A	A
3554	Paper Industries Machinery	50	46	4	-	113	80	33	-
3555	Printing Trades Machinery	69	50	18	1	275	77	A	A
3559	Special Industry Machinery	232	204	26	2	597	296	A	A
3561	Pumps and Compressors	182	152	26	4	713	256	196	261
3562	Ball and Roller Bearings	9	8	1	-	20	A	A	-
3564	Blowers and Fans	81	67	11	3	449	107	A	A
3565	Industrial Patterns	11	9	2	-	20	A	A	-
3566	Power Transmission Equipment	66	59	7	-	143	93	50	-
3567	Industrial Furnaces and Ovens	70	63	7	-	134	91	43	-
3569	General Industry Machinery	172	150	21	1	398	204	A	A
3572	Typewriters	9	3	1	5	221	A	A	199
3573	Electronic Computing Equipment	28	14	10	4	250	24	82	144
3574	Calculating and Accounting Machines	16	7	6	3	248	14	A	A
3576	Scales and Balances	22	15	6	1	90	25	A	A
3579	Office Machines NEC	27	13	12	2	212	22	A	A
3581	Automatic Merchandising Machines	29	14	12	3	213	32	A	A
3582	Commercial Laundry Equipment	41	32	8	1	147	57	A	A
3585	Refrigeration Machinery	221	142	55	24	1,812	244	509	1,059
3586	Measuring and Dispensing Pumps	16	9	4	3	136	11	40	85
3589	Service Industry Machines	102	92	7	3	324	150	70	104
3599	Miscellaneous Machinery, Except Electrical	410	381	26	3	798	510	A	A
3611	Electric Measuring Instruments	100	74	22	4	403	118	166	119
3612	Transformers	72	44	21	7	550	71	210	269
3613	Switchgear and Switchboard Apparatus	150	109	34	7	732	205	288	239
3621	Motors and Generators	127	80	37	10	721	140	274	307
3622	Industrial Controls	88	71	12	5	438	105	107	226
3623	Welding Apparatus	38	33	5	-	109	57	52	-
3624	Carbon and Graphite Products	1	1	-	-	A	A	-	-
3629	Electrical Industrial Apparatus, NEC	46	40	5	1	117	64	A	A
3631	Household Cooking Equipment	28	2	8	18	1,744	A	A	1,628
3632	Household Refrigerators and Freezers	20	4	1	15	2,799	A	A	2,781
3633	Household Laundry Equipment	16	1	3	12	1,976	A	A	1,950
3634	Electric Housewares and Fans	57	25	25	7	507	44	248	215
3635	Household Vacuum Cleaners	9	3	3	3	152	5	44	103
3636	Sewing Machines	7	7	-	-	14	14	-	-

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STUDY OF ECONOMIC IMPACT OF POLLUTION ABATEMENT ON THE ELECTROPLATING INDUSTRY

PAINTING, LACQUERING AND ENAMELING ON METALS OPERATIONS IN METALWORKING INDUSTRY

SIC Code	Industry	Total Establishments	Number of Establishments: Number of Production Workers 1-4	5-19	20 or More	Employment: Total Employees	Employment: Number of Production Workers 1-4	5-19	20 or More
3639	Household Appliances	33	21	3	9	500	36	25	439
3642	Lighting Fixtures	316	192	95	29	2,553	351	910	1,292
3643	Current-Carrying Wiring Devices	26	20	5	1	96	29	A	A
3644	Noncurrent-Carrying Wiring Devices	35	20	10	5	333	41	85	207
3651	Radio and TV Receiving Sets	30	16	11	3	297	42	116	139
3661	Telephone and Telegraph Apparatus	29	6	13	10	540	11	138	391
3662	Radio and TV Communication Equipment	242	178	40	24	1,710	281	360	1,069
3671	Electron Tubes, Receiving Type	2	2	-	-	A	A	-	-
3672	Cathode Ray Picture Tubes	1	-	1	-	A	-	A	-
3673	Electron Tubes, Transmitting	14	12	1	1	85	A	A	A
3674	Semiconductors	10	4	4	2	234	7	A	A
3679	Electronic Components, NEC	165	139	21	5	545	219	143	183
3691	Storage Batteries	8	8	-	-	13	13	-	-
3693	X-Ray Apparatus and Tubes	19	10	6	3	175	16	53	106
3694	Engine Electrical Equipment	46	35	10	1	172	61	A	A
3699	Electrical Equipment, NEC	20	17	3	-	46	22	24	-
3711	Motor Vehicles	84	12	12	60	14,909	16	108	14,785
3713	Truck and Bus Bodies	187	138	33	16	1,288	256	276	756
3714	Motor Vehicle Parts and Accessories	258	175	59	24	1,988	295	542	1,151
3715	Truck Trailers	73	46	21	6	508	76	209	223
3721	Aircraft	34	8	6	20	3,345	14	73	3,258
3722	Aircraft Engines and Engine Parts	40	25	9	6	564	57	77	430
3729	Aircraft Equipment, NEC	140	92	31	17	1,571	168	243	1,160
3731	Ship Building and Repairing	28	12	5	11	1,494	19	48	1,427
3732	Boat Building and Repairing	68	47	18	3	390	88	142	160
3741	Locomotives and Parts	9	6	-	3	166	6	-	160
3742	Railroad and Street Cars	47	18	13	16	1,159	30	115	1,014
3751	Motorcycles, Bicycles and Parts	24	9	6	9	377	18	59	300
3791	Trailer Coaches	51	44	3	4	378	A	A	A
3799	Transportation Equipment, NEC	94	71	22	1	356	135	A	A
3811	Engineering and Scientific Instruments	97	78	17	2	330	121	A	A
3821	Mechanical Measuring Devices	139	112	18	9	607	175	146	286
3822	Automatic Temperature Controls	21	12	5	4	183	23	60	100
		10,780	7,931	1,974	875	91,024	12,845	14,386	58,402

Note: A - Not Available - Information suppressed to protect specific plants in survey.

Source: 1967 Census of Manufactures.

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ENVIRONMENTAL PROTECTION AGENCY

ECONOMIC IMPACT OF POLLUTION ABATEMENT
ON THE ELECTROPLATING INDUSTRY
SUMMARY OF IN-PLANT ELECTROPLATING OPERATIONS

SIC Number	Industry	Total Industry		Plants Over Ten Employees		Electroplating and Other Plating		Galvanizing and Other Hot Dip Coating		Painting, Lacquering and Enameling	
		Establishments	Employees	Establishments	Employees	Establishments	Employees	Establishments	Employees	Establishments	Employees
1925	Complete Guided Missiles	417	400,400	350	400,100	12	417	3	103	20	372
1929	Ammunition, Except for Small Arms, NEC					11	78	6	53	36	805
1931	Tanks and Tank Components					4	A	2	A	10	201
1951	Small Arms					7	86	4	A	10	53
1961	Small Arms Ammunition					4	53			2	A
1999	Guns, Howitzers, and Ordnance Access.					9	82	4	27	20	80
3321	Gray Iron Foundries	1,061	138,000	871	137,400						
3322	Malleable Iron Foundries	81	25,400	76	25,400						
3323	Steel Foundries	296	69,200	265	69,100						
3361	Aluminum Castings	992	45,200	572	43,800						
3362	Brass, Bronze, Copper Castings	534	17,900	333	17,200						
3369	Nonferrous Castings, NEC	360	26,600	230	26,100						
3391	Iron and Steel Forgings	272	41,200	218	41,000						
3392	Nonferrous Forgings	41	10,100	37	10,100						
3411	Metal Cans	299	60,300	270	60,200					102	3,479
3421	Cutlery	146	13,000	86	12,800	15	112			16	43
3423	Hand, and Edge Tools, NEC	667	35,900	342	34,900	57	357			115	408
3425	Handsaws and Saw Blades	85	6,300	61	6,200	8	31			20	83
3429	Hardware, NEC	1,041	100,800	616	99,500	137	3,120	10	156	238	2,058
3431	Metal Sanitary Ware	91	10,100	65	10,000	4	A			20	1,329
3432	Plumbing Fittings and Brass Goods	214	14,500	116	14,300	39	681			12	37
3433	Heating Equipment, except Electric	533	40,600	322	39,900	7	52	1	A	203	1,359
3441	Fabricated Structural Steel	1,960	107,500	1,430	105,400	3	29	15	428	511	1,930
3442	Metal Doors, Sash and Trim	1,646	63,900	871	61,400	20	511	1	A	153	696
3443	Fabricated Platework-Boiler Shops	1,465	96,400	1,029	94,900	7	9	10	106	357	1,281
3444	Sheet Metal	3,054	68,100	1,341	62,800	12	30	27	85	291	1,127
3446	Architectural Metalwork	1,377	19,300	347	16,600	3	5	2	A	169	550
3449	Miscellaneous Metalwork	649	32,700	348	31,700	3	A	2	A	82	573
3451	Screw Machine Products	1,874	49,000	1,057	46,100	20	74	4	6	20	36
3452	Bolts, Nuts, Rivets and Washers	662	67,200	483	66,600	84	856	16	82	26	95
3461	Metal Stampings	2,710	225,900	1,825	222,700	119	1,230	24	282	385	5,986
3481	Miscellaneous Fabricated Wire Products	1,550	60,200	822	57,700			31	173	236	732
3491	Metal Barrels, Drums and Pails	149	11,600	112	11,500			1	A	91	905
3492	Safes and Vaults	32	3,800	23	3,800	2	A			15	110
3493	Steel Springs	114	7,700	76	7,500	2	A			37	112
3494	Valves and Pipe Fittings	666	95,300	501	94,800	34	163	17	176	133	402
3496	Collapsible Tubes	19	4,300	18	3,900					13	915
3497	Metal, Foil and Leaf	72	6,600	53	6,600					1	A
3498	Fabricated Pipe and Fittings	393	18,200	264	17,800	11	93	8	38	44	103
3499	Fabricated Metal Products, NEC	1,266	41,300	683	39,500	42	194	8	32	219	964
3511	Steam Engines and Turbines	27	36,200	21	36,000	2	A			14	134
3519	Internal Combustion Engines, NEC	155	63,700	111	63,600	14	253			55	538
3522	Farm Machinery	1,618	136,300	886	134,300					567	3,319
3531	Construction Machinery	651	133,100	426	132,400					260	1,757
3532	Mining Machinery	212	21,700	148	21,500					62	231
3533	Oilfield Machinery	360	32,700	225	32,400					99	313
3534	Elevators and Moving Stairways	144	13,900	99	13,700					48	236
3535	Conveyors and Conveying Equipment	446	27,400	283	26,900					157	334
3536	Hoists, Cranes and Monorails	141	16,800	96	16,700					51	197
3537	Industrial Trucks and Tractors	351	27,000	203	26,500					108	358
3541	Machine Tools, Metal-Cutting Types	903	87,200	505	85,800	13	96			142	871
3542	Machine Tools, Metal-Forming Types	350	29,200	223	28,800	5	11			70	172
3544	Special Dies, Tools, Jigs and Fixtures	6,615	113,600	2,846	101,200	29	139			91	121
3545	Machine Tool Accessories	1,141	60,300	630	58,600					58	148
3548	Metalworking Machinery, NEC	430	46,700	249	46,200	16	66			79	274
3551	Food Processing Machinery	642	32,600	366	31,700					181	436
3552	Textile Machinery	560	39,700	308	38,900					84	363
3553	Woodworking Machinery	239	12,700	119	12,200	10	129			69	224
3554	Paper Industries Machinery	220	21,300	146	21,000					50	113
3555	Printing Trades Machinery	522	29,200	254	28,400					69	275
3559	Special Industry Machinery, NEC	1,129	71,300	680	70,000	23	114	8	12	232	597
3561	Pumps and Compressors	660	78,300	392	77,500			8	32	261	7,248
3562	Ball and Roller Bearings	124	58,800	108	58,800	11	69			80	6,385
3564	Blowers and Fans	287	21,000	172	20,600	4	17	2	A	81	449
3565	Industrial Patterns	1,163	10,900	314	8,600					11	20
3566	Power Transmission Equipment	513	54,800	376	54,400	16	82	1	A	66	143
3567	Industrial Furnaces and Ovens	255	16,100	150	15,900					70	134
3569	General Industry Machinery, NEC	758	39,400	460	38,400	10	44	4	7	172	398
3572	Typewriters	25	26,000	20	26,000	7	279			9	221

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ECONOMIC IMPACT OF POLLUTION ABATEMENT
ON THE ELECTROPLATING INDUSTRY
SUMMARY OF IN-PLANT ELECTROPLATING OPERATIONS

SIC Number	Industry	Total Industry		Plants Over Ten Employees		Electroplating and Other Plating		Galvanizing and Other Hot Dip Coating		Painting, Lacquering and Enameling	
		Establishments	Employees	Establishments	Employees	Establishments	Employees	Establishments	Employees	Establishments	Employees
3573	Electronic Computing Equipment	178	98,900	163	98,900	25	372	2	A	28	250
3574	Calculating and Accounting Machines	138	38,400	67	38,200	11	416			16	248
3576	Scales and Balances	76	6,500	42	6,400	1	A			22	90
3579	Office Machines, NEC	177	20,700	98	20,500	9	123			27	212
3581	Automatic Merchandising Machines	150	10,000	75	9,800	8	34			29	213
3582	Commercial Laundry Equipment	117	7,500	69	7,300	5	14	1	A	41	147
3585	Refrigeration Machinery	682	94,800	452	94,100	14	81	8	116	221	1,812
3586	Measuring and Dispensing Pumps	49	6,400	29	6,300			2	A	16	136
3589	Service Industry Machines, NEC	575	20,900	276	20,000	7	16	4	8	102	324
3599	Miscellaneous Machinery, except Electrical	15,109	202,500	4,653	172,000	107	572			410	798
3611	Electric Measuring Instruments	546	61,500	331	60,800	37	286			100	403
3612	Transformers	190	45,600	139	45,400					72	550
3613	Switchgear and Switchboard Apparatus	482	68,500	336	68,000	80	583			150	732
3621	Motors and Generators	409	112,800	315	112,500	29	132	5	59	127	721
3622	Industrial Controls	476	50,400	260	49,700	17	262			88	438
3623	Welding Apparatus	147	13,700	102	13,500					38	109
3624	Carbon and Graphite Products	65	11,900	49	11,900					1	A
3629	Electrical Industrial Apparatus, NEC	219	17,900	144	17,700					46	117
3631	Household Cooking Equipment	73	20,400	56	20,400	8	106			28	1,744
3632	Household Refrigerators and Freezers	36	53,000	25	52,900	3	106	1	A	20	2,799
3633	Household Laundry Equipment	35	22,200	29	22,100	6	111	1	A	16	1,976
3634	Electric Housewares and Fans	290	44,600	166	44,300	36	607	1	A	57	507
3635	Household Vacuum Cleaners	34	9,200	23	9,200	4	105			9	152
3636	Sewing Machines	86	6,400	30	6,200	5	A			7	14
3639	Household Appliances, NEC	83	13,400	58	13,300	2	A	1	A	33	500
3641	Electric Lamps	106	29,500	69	29,400						
3642	Lighting Fixtures	1,213	64,600	684	63,000	75	754	5	15	316	2,553
3643	Current-Carrying Wiring Devices	375	40,100	233	39,600	40	431	8	31	26	96
3644	Noncurrent-Carrying Wiring Devices	174	22,900	125	22,700	13	178	19	727	35	333
3651	Radio and TV Receiving Sets	340	116,700	209	116,300	14	277	2	A	30	297
3661	Telephone and Telegraph Apparatus	106	115,400	69	115,300	25	615	3	A	29	540
3662	Radio and TV Communication Equipment	1,296	409,500	931	408,500	114	1,583	24	281	242	1,710
3671	Electron Tubes, Receiving Type	39	21,000	24	20,900					2	A
3672	Cathode Ray Picture Tubes	99	27,600	30	27,500	2	A			1	A
3673	Electron Tubes, Transmitting	56	18,200	45	18,200	14	109	2	A	14	85
3674	Semiconductors	177	85,400	126	85,200	38	428	2	A	10	234
3679	Electronic Components, NEC	2,068	251,300	1,444	249,200	184	1,811	31	64	165	545
3691	Storage Batteries	232	19,300	140	19,000					8	13
3692	Primary Batteries, Dry and Wet	49	11,000	37	11,000						
3693	X-Ray Apparatus and Tubes	82	7,900	47	7,900					19	175
3694	Engine Electrical Equipment	264	55,400	173	55,100	24	242	6	33	46	172
3699	Electrical Equipment, NEC	538	13,600	178	12,600					20	46
3711	Motor Vehicles	181	321,200	142	321,200	10	A	2	A	4	14,909
3713	Truck and Bus Bodies	641	30,400	364	29,400	1	A	3	A	187	1,288
3714	Motor Vehicle Parts and Accessories	1,674	364,900	957	363,100	98	1,699	20	680	258	1,988
3715	Truck Trailers	179	22,900	125	22,700			1	A	73	508
3721	Aircraft	125	386,800	91	386,700	23	760	8	354	34	3,345
3722	Aircraft Engines and Engine Parts	255	195,400	222	195,300	37	1,353	6	A	40	564
3729	Aircraft Equipment, NEC	893	219,800	641	219,000	73	759	6	67	140	1,571
3731	Ship Building and Repairing	415	138,800	306	138,400					108	4,190
3732	Boat Building and Repairing	1,596	30,500	463	27,600					68	390
3741	Locomotives and Parts	27	16,000	20	A					9	166
3742	Railroad and Street Cars	96	40,600	79	40,500					47	1,159
3751	Motorcycles, Bicycles and Parts	91	12,000	41	11,800					24	377
3791	Trailer Coaches	856	43,600	525	42,800	1	A	1	A	51	378
3799	Transportation Equipment, NEC	454	11,200	206	10,400	4	A			94	356
3811	Engineering and Scientific Instruments	677	46,100	376	45,100	22	58			97	330
3821	Mechanical Measuring Devices	661	72,900	377	72,100	35	290			139	607
3822	Automatic Temperature Controls	105	31,400	72	31,300	17	163			21	183
3871	Watches and Clocks	176	31,500	97	31,300	17	276				
3872	Watchcases	47	3,700	25	3,600	12	61				
		84,214	7,779,600	44,611	7,641,400	2,143	25,344	394	4,233	11,044	106,933

Note: A - Not Available - Information suppressed to protect specific plants in survey.

Source: 1967 Census of Manufactures.